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SIXPENCE.
(REGISTERED AS A NEWSPAPER.)

FRIDAY,
DECEMBER 2, 1904.

1904
UNIVERSITY OF TORONTO

PAGE'S WEEKLY

ENGINEERING · ELECTRICITY SHIPBUILDING MINING IRON & STEEL INDUSTRIES

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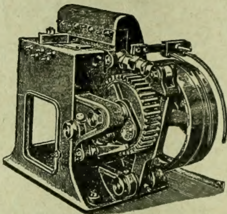

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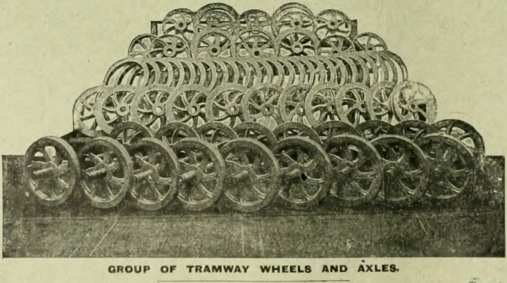

GROUP OF TRAMWAY WHEELS AND AXLES.

HADFIELD'S PATENT "ERA" MANGANESE STEEL
IS THE SUPREME MATERIAL FOR
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PAGE'S WEEKLY Miscellaneous

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Rolled Steel Joists, Channels, etc.

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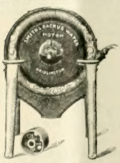

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Backus Water Motors

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Will drive any class of Machinery, and work on 15 lb. pressure.

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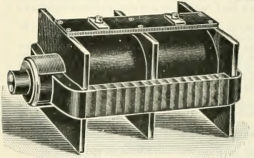

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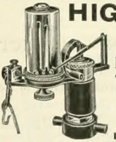

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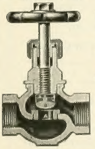

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A

PAGE'S WEEKLY Contracts

CONTRACTS.

ASYLUMS COMMITTEE OF LONDON COUNTY COUNCIL.

The Asylums Committee of the London County Council are prepared to receive **TENDERS** for the **INSTALLATION** of **HEATING, VENTILATING,** and **HOT-WATER PLANT** at the Long Grove, Asylum, Epsom, Surrey, now in course of erection.

Instructions for Tender and forms of Tender and Contract, with specification and schedules thereto annexed, together with plans and cover, can be obtained from the Clerk of the Committee, No. 6, Waterloo Place, London, S.W., on or after Thursday, the 1st December proximo, on payment of a deposit of £5 for each copy. The amount deposited will, after the Committee have come to a decision upon the Tenders received, but not before, be returned to the tenderer, provided he shall have sent in a *bonâ fide* Tender and shall not have withdrawn the same.

Tenders must be on the printed form, and must be accompanied by the form of contract and schedules thereto and bond.

The Tender and accompanying documents, completed in accordance with the instructions, must be enclosed in the authorised sealed cover, endorsed "Tender for Heating, Long Grove Asylum," and be delivered at the Office of the Committee. 6, Waterloo Place, London, S.W., on or before Monday, the 23rd January, 1905, after which no Tender will be received.

Any Tender not made on the printed form, or not filled up and complete in every particular in accordance with the instructions, will be rejected.

The Committee do not bind themselves to accept the lowest or any Tender.

The contractor will have to enter into a bond in the penal sum of £2,000, with two approved sureties, each in the sum of £1,000, as security for the due performance of the contract.

R. W. PARTRIDGE,
Clerk of the Asylums Committee.

Asylums Committee Office,
6, Waterloo Place, London, S.W.,
November 16th, 1904.

EAST COWES URBAN DISTRICT COUNCIL, ISLE OF WIGHT.

TENDERS FOR ENGINE AND SUCTION GAS PLANT.

Subject to the sanction of the Local Government Board to the necessary loans being obtained,

The Council invite **TENDERS** for one 50-H.P. **ENGINE** and **SUCTION GAS PLANT**, fitted and fixed complete, in accordance with the printed forms of specification and Tender, which can be obtained from their Engineer, W. Brown, 709, High Road, Tottenham. or from Albert E. Barton, Town Hall, East Cowes, Surveyor to the Council, upon the deposit of £2 2s., which will be returned on receipt of a *bonâ fide* Tender.

The person or firm whose Tender is accepted will be required to enter into a written contract and provide two sureties.

Sealed Tenders to be sent to the Offices of the Council, Cowes, addressed to the Clerk to the Urban District Council, and endorsed "Tenders for Engine and Suction Gas Plant," on or before the 7th December, 1904.

The Council do not bind themselves to accept any Tender.

ATHERSTONE DAMANT,
Clerk to the Council.

Council Offices, Cowes,
November 12th, 1904.

EAST COWES URBAN DISTRICT COUNCIL, ISLE OF WIGHT.

TO PUMP MAKERS.

Subject to the sanction of the Local Government Board for the necessary loans being obtained,

The Council invite **TENDERS** for **ONE SET** of 8 in. **THREE-THROW DEEP-WELL PUMPS**, fitted and fixed in Well, with 6 in. Rising Main and all necessary Gear, &c., in accordance with printed forms of specification and Tender, which can be obtained from their Engineer, W. Brown, 709, High Road, Tottenham, or from Albert E. Barton, Town Hall, East Cowes, Surveyor to the Council, upon the deposit of £2 2s., which will be returned on receipt of a *bonâ fide* Tender.

The person or firm whose Tender is accepted will be required to enter into a written contract and to provide two sureties.

Sealed Tenders to be sent to the Offices of the Council, Cowes, addressed to the Clerk of the Urban District Council, and endorsed "Tender for 8 in. Three-throw Pumps," on or before the 7th December, 1904.

The Council do not bind themselves to accept any Tender.

ATHERSTONE DAMANT,
Clerk to the Council.

Council Offices, Cowes,
November 12th, 1904.

COUNTY OF LONDON. — TO GAS ENGINEERS AND OTHERS.

The London County Council invites **TENDERS** for the **SUPPLY, DELIVERY,** and **ERECTION**, complete, of three **MAIN-DRIVING GAS ENGINES**, together with certain **AUXILIARY GAS ENGINES** and all accessories, at the Council's Falcon Brook Pumping Station, to be erected in York Road, Battersea.

Persons desiring to submit Tenders may obtain the drawings, specifications, bills of quantities, form of Tender, and other particulars, upon application to the Council's Chief Engineer, Mr. MAURICE FITZMAURICE, C.M.G., at the County Hall, Spring Gardens, S.W., and upon payment to the Cashier of the Council of the sum of Two Pounds. This amount will, after the Council or its Committee have come to a decision upon the Tenders received, but not before, be returned to the tenderer, provided he shall have sent in a *bonâ fide* Tender and not have withdrawn the same.

Tenders must be upon the official forms, and the printed instructions contained therein must be strictly complied with.

The contractors will be bound by the contract to pay to all workmen (except a reasonable number of legally bound apprentices) employed by them wages at rates not less and to observe hours of labour not greater than the rates and hours set out in the Council's list, and such rates of wages and hours of labour will be inserted in and form part of the contract by way of schedule.

Each Tender is to be delivered at the County Hall, in a sealed cover, addressed to the Clerk of the London County Council, Spring Gardens, S.W., and marked "Tender for Gas Engines, Falcon Brook Pumping Station."

No Tender will be received after 10 a.m. on Tuesday, the 6th day of December, 1904.

Any Tender which does not comply with the printed instructions for Tender may be rejected.

The Council does not bind itself to accept the lowest or any Tender and it will not accept the Tender of any person or firm who shall on any previous occasion have withdrawn a Tender after the same had been opened, unless the reasons for the withdrawal were satisfactory to the Council.

G. L. GOMME,
Clerk of the London County Council.

County Hall, Spring Gardens, S.W.,
16th November, 1904.

EAST COWES URBAN DISTRICT COUNCIL, ISLE OF WIGHT.

TENDERS FOR MAIN FROM WATERWORKS TO TOWER.

Subject to the sanction of the Local Government Board for the necessary loans being obtained,

The Council invite **TENDERS** to **LAY** a 6 in. **CAST IRON MAIN** from the Waterworks to the Water Tower and along Victoria Grove, together with valves and all necessary fittings, in accordance with the printed forms of specifications and Tender, which can be obtained from their Engineer, W. Brown, 709, High Road, Tottenham, or from Albert Barton, Town Hall, East Cowes, Surveyor to the Council, upon the deposit of £2 2s., which will be returned on receipt of a *bonâ fide* Tender.

The person or firm whose Tender is accepted will be required to enter into a written contract and to provide two sureties.

Sealed Tenders to be sent to the Office of the Council, Cowes, addressed to the Clerk to the Urban District Council, and endorsed "Tender for Water Main," on or before the 7th December, 1904.

The Council do not bind themselves to accept any Tender.

ATHERSTONE DAMANT,
Clerk to the Council.

Council Offices, Cowes,
November 12th, 1904.

JOHANNESBURG MUNICIPALITY.

The Municipal Council of Johannesburg is prepared to receive

TENDERS FOR :—

TRANSFORMER PILLARS and **SWITCHGEAR** to Specification No. 8, of their Consulting Engineers, Messrs. MORDEY AND DAWBARN, 82, Victoria Street, London, S.W.

Copies may be seen on and after Saturday, November 5th, at the Council Offices, Johannesburg, and at the Consulting Engineers' Offices in London, and may be obtained on payment of Five Guineas, which will be returned on receipt of a *bonâ fide* Tender.

Tenders must be addressed to Messrs. MORDEY & DAWBARN, 82, Victoria Street, Westminster, S.W., and received by them not later than Tuesday, December 27th, 1904.

The lowest or any Tender will not necessarily be accepted, and the Council will not be responsible for any expenses incurred in Tendering.

R. FEETHAM,
Town Clerk.

Johannesburg.

PAGE'S WEEKLY Contracts

COUNTY BOROUGH OF CARDIFF.

TO MAKERS OF PUMPING MACHINERY, STEAM BOILERS, AND GAS ENGINES.

The Corporation of the County Borough of Cardiff hereby invite competitive **DESIGNS** and **TENDERS** (from manufacturers of repute only in the particular class of work tendered for) for the **SUPPLY, DELIVERY, and ERECTION of PUMPING MACHINERY and PLANT** required in connection with the proposed Western District Main Outfall Sewer as follows :—

CONTRACT No. 1.—For combined Sewage Pumping Engines and Pumps of a maximum capacity of 700,000 gallons per hour.

CONTRACT No. 2.—For the Steam Generating Plant required for Contract No. 1.

CONTRACT No. 3.—For two Sets of Gas Engines and Centrifugal Storm-water Pumps, each capable of discharging 680,000 gallons per hour.

Drawings and provisional specification may be seen and full particulars as to the contemplated works may be obtained at the office of Mr. W. HARPUR, M.Inst.C.E., the Borough Engineer, Town Hall, Cardiff, on and after Monday November 7th, and copies of the drawings and specification, with forms of Tender, will be supplied on receipt of a deposit of Five Guineas, which deposit will be returned on receipt of a *bonâ fide* Tender.

Tenders, sealed and endorsed "Tenders for Pumping Machinery," to be delivered at my office on or before Wednesday, December 21st.

The Corporation does not bind itself to accept the lowest or any Tender, and will not be liable for or defray any costs incurred in the preparation of any Designs and Tenders.

Town Hall, Cardiff, J. L. WHEATLEY, Town Clerk.
October 31st, 1904.

BOROUGH OF CHIPPENHAM URBAN DISTRICT COUNCIL.

WORKS OF SEWERAGE AND SEWAGE DISPOSAL.

The Chippenham Urban District Council are prepared to receive **TENDERS** for the following **NEW SEWERS**, with **MANHOLES, FLUSHING CHAMBERS**, and other works connected therewith :—

About 850 yards of 9 in. diam. Pipe Sewers.
2280 " 12 in. "
627 " 15 in. "
564 " 18 in. "
848 " 21 in. "

The building of Detritus and Screening Tanks, Liquifying Tanks, Contact Filter Beds, Low-level Collecting Tank, Percolating Storm Filter, Engine and Pump House. The fixing of all Machinery, Valves, Pipes, &c.

Conditions, specification, quantities, and form of Tender may be obtained from the Engineer, Mr. A. E. ADAMS, A.M.I.M.E., High Street, Chippenham, Wilts, on payment of the sum of £2 2s., which will be returned on the receipt of a *bonâ fide* Tender and of the conditions, specification, and priced quantities.

The drawings may be seen at the Engineer's Office.

Sealed Tenders, upon the form supplied, to be sent in addressed to the Town Clerk, Chippenham, Wilts, not later than Ten o'clock in the morning of Tuesday, the thirteenth day of December, 1904, and endorsed "Tender for Chippenham Main Drainage, &c."

The Council do not bind themselves to accept the lowest or any Tender.

FRANCIS H. PHILLIPS, Town Clerk.

Chippenham, Wilts.
November, 1904.

THE SOUTH INDIAN RAILWAY COMPANY, LIMITED,
is prepared to receive

TENDERS FOR THE SUPPLY OF :—

(1) GENERAL STORES: Comprising Hardware, Iron, Steel Metals, Oils and Colours, Leather, Rubber, and Sundries.
(2) LOCOMOTIVE STORES: Comprising Cranks, Copper and Steel Plates, Tyres, Axles, Springs, and Trollies.
(3) STATIONERY: Comprising Books, Paper, Envelopes, Ink, and Sundries
(4) ROOFING: Five Spans of 100 ft. by 25 ft.
(5) FENCING: About 60 tons.

Specifications and Forms of Tender may be obtained at the Company's Offices.

Tenders, addressed to the Chairman and Directors of the South Indian Railway Co., Limited, marked "Tender for General Stores," or as the case may be, must be left with the undersigned not later than Twelve o'clok noon of Tuesday, the 13th December, 1904.

The Company is not bound to accept the lowest or any Tender.

A charge, which will not be returned, will be made of 20s. for each copy of Specification No. 1, and of 10s. for each copy of Nos. 2, 3, 4, and 5.

Copies of the Drawings may be obtained at the Office of Sir GEORGE B. BRUCE, 3, Victoria Street, Westminster, on payment of 5s. per sheet.

By order, HENRY W. NOTMAN,
Managing Director.
Company's Offices,
55, Gracechurch Street, London, E.C.,
November 25th, 1904.

JOHANNESBURG MUNICIPALITY.

The Municipal Council of Johannesburg is prepared to receive

TENDERS FOR

TWO 35 ton ELECTRIC OVERHEAD TRAVELLING CRANES

to Specification No. 9 of their Consulting Engineers, Messrs. MORDEY AND DAWBARN, 82, Victoria Street, London, S.W.

Copies may be seen on and after Saturday, November 5th, at the Council Offices, Johannesburg and at the Consulting Engineers' Offices in London, and may be obtained on payment of Five Guineas, which will be returned on receipt of a *bona fide* Tender.

Tenders must be addressed to Messrs. MORDEY AND DAWBARN, 82, Victoria Street, Westminster, S.W., and received by them not later than Tuesday, December 27th, 1904.

The lowest or any Tender will not necessarily be accepted, and the Council wiil not be responsible for any expenses incurred in Tendering.

R. FEETHAM,
Johannesburg. Town Clerk.

WELWYN RURAL DISTRICT COUNCIL.

WELWYN SEWAGE DISPOSAL.

CONTRACT No. 2.

TO OIL ENGINE AND PUMP MAKERS.

The above-named Council are prepared to receive **TENDERS** for the **SUPPLY, DELIVERY, ERECTING**, and **SETTING to WORK** of **TWO OIL ENGINES** and **TWO TREBLE-RAM PUMPS**, together with other Machinery, Fittings, Pipes, Tools, &c., in the Parish of Welwyn, Hertfordshire.

Specifications may be obtained from the office of the Engineers, Messrs. HERBERT WALKER and SON, Assoc. M.M.Inst.C.E., Albion Chambers, King Street, Nottingham, on payment of Two Guineas, which will be returned on receipt of a *bona fide* Tender.

Sealed Tenders, on the form supplied, and accompanied by the contractor's full detailed specification and drawings, and endorsed "Welwyn Sewage Disposal.—Contract No. 2," to be delivered to me on or before Monday, the 19th day of December, 1904.

The Tenders will be opened at the meeting of the Council to be held at the Board-room, Union Workhouse, Welwyn, on Wednesday, the 21st day of December, 1904, at 10.30 a.m.

The lowest or any Tender will not necessarily be accepted.

By order of the Council,
Council Offices, THOMAS J. SWORDER,
November 22nd, 1904. Clerk.

COUNTY OF LONDON.—THE LONDON COUNTY COUNCIL TRAMWAYS.

TO ENGINEERS AND OTHERS.

The London County Council invites **TENDERS** for the **MANUFACTURE, SUPPLY, DELIVERY**, and **ERECTION** of **SEVEN CAST IRON WATER TANKS**, &c., required for use at the Council's electricity generating station at Greenwich.

The tanks are to be of the following dimensions : One tank, 45 ft. 9 in. by 30 ft. 9 in. by 6 ft., internal dimensions ; two tanks, 45 ft. 9 in. by 12 ft. 9 in. by 6 ft., internal dimensions ; and four tanks, 15 ft. 9 in. by 9 ft. 9 in. by 6 ft., internal dimensions.

Persons desiring to submit Tenders may obtain the drawings, specification, form of Tender, &c., at the County Hall, Spring Gardens, S.W., upon payment to the Cashier of the Council of the sum of Two Pounds. This amount will, after the Council or its Committee have come to a decision upon the Tenders received, but not before, be returned to the tenderer, provided he shall have sent in a *bona fide* Tender and not have withdrawn the same, but in no case will the fee be returned unless a *bona fide* Tender is submitted.

Full particulars of the work may be obtained on application at the County Hall, previously to the payment of the fee for the specification, &c.

Tenders must be upon the official forms, and the printed instructions contained therein must be strictly complied with.

The contractors will be bound by the contract to pay to all workmen (except a reasonable number of legally bound apprentices) employed by them wages at rates not less and to observe hours of labour not greater than the rates and hours set out in the Council's list, and such rates of wages and hours of labour will be inserted in and form part of the contract by way of schedule.

Each Tender is to be delivered at the County Hall, in a sealed cover, addressed to the Clerk of the London Council, Spring Gardens, S.W., and marked "Tender for Water Tanks, L.C.C. Tramways."

No Tender will be received after 10 o'clock a.m. on Tuesday, the 13th day of December, 1904.

Any Tender which does not comply with the printed instructions for Tender may be rejected.

The Council does not bind itself to accept the lowest or any Tender, and it will not accept the Tender of any person or firm who shall on any previous occasion have withdrawn a Tender after the same had been opened, unless the reasons for the withdrawal were satisfactory to the Council.

G. L. GOMME,
Clerk of the London County Council.
County Hall, Spring Gardens, S.W.

BUYERS' DIRECTORY.

NOTE.—*The display advertisements of the firms mentioned under each heading can be found readily by reference to the Alphabetical Index to Advertisers on pages* 23 and 25.

In order to assure fair treatment to advertisers, each firm is indexed under its leading speciality ONLY.

Advertisers who prefer, however, to be entered under two or more different sections can do so by an annual payment of 5s. for each additional section.

Artesian Well Machinery.
John Z. Thom, Patricroft, Manchester.

Belting.
Binney & Son, Catherine Street. City Road, London, E.C.
Fleming, Birkby & Goodall, Ltd., West Grove, Halifax.
Rossendale Belting Co., Ltd., 10, West Mosley Street, Manchester.

Boilers.
Clayton, Son & Co., Ltd., Leeds City Boiler Works, Leeds.
Grantham Crank & Iron Co., Ltd., Grantham.
John Thompson, Wolverhampton.

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Babcock & Wilcox, Ltd., Oriel House, Farringdon Street, London, E.C.
Cochran & Co. (Annan), Ltd., Annan, Scotland.

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Atlantic Press, Ltd., Weymouth Street, Manchester.
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Spottiswoode Advertising Agency, 8, New Street Square, E.C.

Chucks.
Fairbanks Co., 78-80, City Road, London, E.C.

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David Bridge & Co., Castleton Ironworks, Rochdale, Lancashire.
H. J. H. King & Co., Nailsworth, Gloucestershire.

Colliery Plants.
Graham, Morton & Co., Ltd., Leeds.

Condensing Plant.
Concentric Condenser, Ltd., 23, Northumberland Avenue, London, W.C.
Mirrlees-Watson & Co., Ltd., Glasgow.

Consulting Engineers.
G. H. Hughes, A.M.I.M.E., 97, Queen Victoria Street, London, E.C.

Continental Railway Arrangements.
South Eastern & Chatham Railway Co.

Conveying and Elevating Machinery.
Adolf Bleichert & Co., Leipzig-Gohlis, Germany.
Brown Hoisting Machinery Co.. 39, Victoria Street, London, S.W.
Fraser & Chalmers, Ltd., 3, London Wall Buildings, London, E.C.
Graham, Morton & Co., Ltd., Leeds.
Temperley Transporter Co., 72, Bishopsgate Street Within, London, E.C.

Coverings (Boiler)
Magnesia Coverings, Ltd., Washington Station, co. Durham.

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Joseph Booth & Bros. Ltd, Rodley, Leeds.
Thomas Broadbent & Sons, Ltd., Huddersfield.
Niles-Bement Pond Co., 23-25, Victoria Street, London, S.W.

Cranks.
Clarke's Crank & Forge Co., Ltd., Lincoln, England.

Cutters (Milling).
E. G. Wrigley & Co., Ltd., Foundry Lane Works, Soho, Birmingham.

Destructors.
Horsfall Destructor Co., Ltd., Armley, Leeds.

Dredges and Excavators.
Delange & Cie, Mce., Hoboken, near Antwerp.
Rose, Downs & Thompson, Ltd., Old Foundry, Hull.

Economisers.
E. Green & Son, Ltd., Manchester.

Ejectors (Pneumatic).
Hughes & Lancaster, 47, Victoria Street, London, S.W.

Electrical Apparatus.
Allgemeine Elektricitäts Gesellschaft, Berlin, Germany.
Broadbent, T. W., Victoria Electrical Works, Huddersfield.
Bruce Peebles & Co., Ltd., Edinburgh.
Brush Electrical Engineering Co., Ltd., Victoria Works Belvedere Road, London, S.E.
Crompton & Co., Ltd., Arc Works, Chelmsford.
Crypto Electrical Co., 3, Tyer's Gateway, Bermondsey Street, London, S.E.
Gent & Co., Ltd., Faraday Works, Leicester.
Greenwood & Batley, Ltd.. Albion Works, Leeds.
India Rubber, Gutta Percha, and Telegraph Works Co., Ltd., The, Silvertown, London, E.
Mather & Platt, Ltd., Salford Iron Works, Manchester.
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Mix and Genest, Berlin, W., Germany.
Nalder Bros. & Thompson, 34. Queen Street, London, E.C.
Newton Brothers, Full Street, Derby.
Phœnix Dynamo Manufacturing Co., Bradford, Yorks.
Premier Electrolyte Co., 26, Spital Square, London, E.
Simplex Steel Conduit Co., Ltd., 20, Bucklersbury, London, E.C.
Sturtevant Engineering Co., Ltd., 147, Queen Victoria Street, London, E.C.
Turner, Atherton & Co., Ltd., Denton, Manchester.
B. Weaver & Co., 22, Rosoman Street, Clerkenwell, London, E.C.

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J. & H. McLaren, Midland Engine Works Leeds.

Engines (Locomotive).
Baldwin Locomotive Works, Philadelphia, Pa., U.S.A.
Hunslet Engine Co., Ltd., Leeds, England.
Hudswell, Clarke & Co., Ltd., Leeds, England.

Engines (Stationary).
Allis-Chalmers Co., 533, Salisbury House, Finsbury Circus, London, E.C.
Fraser & Chalmers, Ltd., 3, London Wall Buildings, London, E.C.
Momentum Engine, 19, 19a, Imperial Buildings, Ludgate Circus, London, E.C.
Soest, L., & Co., Ltd., 114-116, Victoria Street, London, S.W.

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Jno. Fowler & Co. (Leeds), Ltd., Steam Plough Works, Leeds.
Garrett & Sons, Ltd., Richard, Leiston, R.S.O., Suffolk.

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Matthews & Yates, Ltd., Swinton, Manchester.

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J. H. Sankey & Son, Ltd., Essex Wharf, Canning Town, London, E.
E. J. & J. Pearson, Ltd., Stourbridge.

Firewood Machinery.
M. Glover & Co., Patentees and Saw Mill Engineers, Leeds.

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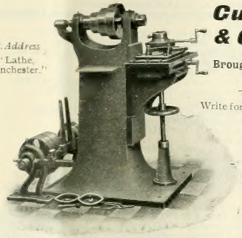

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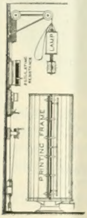

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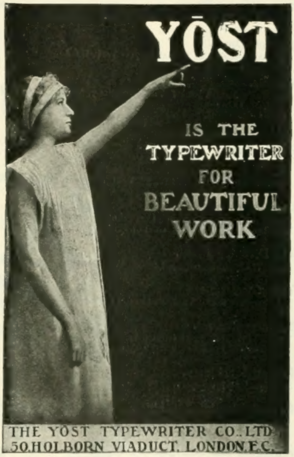

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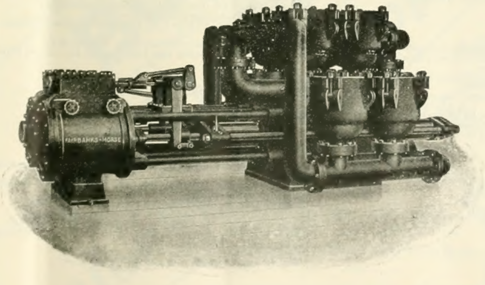

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Hamilton & Co., J. B., 145, Cannon Street, E.C.

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Fraser & Chalmers, Ltd., 3, London Wall Buildings, London, E.C.

Gauge Glasses.

J. B. Treasure & Co., Vauxhall Road, Liverpool.

Hammers (Steam).

Davis & Primrose, Leith Ironworks, Edinburgh.
Niles-Bement Pond Co., 23-25, Victoria Street, London, S.W.

Hoisting Machinery.

See Conveying Machinery.

Horizontal Boring Machines.

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Niles-Bement Pond Co., 23-25, Victoria Street, London, S.W.

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Hadfield's Steel Foundry Co., Ltd., Sheffield.
J. Frederick Melling, 14, Park Row, Leeds, England.
Parker Foundry Co,, Derby.
Purden, John & Sons, Lambhill Forge, by Maryhill, Glasgow.
Walter Scott, Ltd., Leeds Steel Works, Leeds, England.
Gilbert Thompson & Co., 116, Victoria Street, London, S.W.
Woodhouse & Rixson, Sheffield.

Ironwork (Constructional).

F. A. Keep, Juxon & Co., Barn Street, Birmingham.

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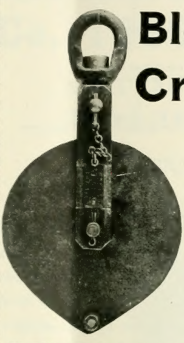

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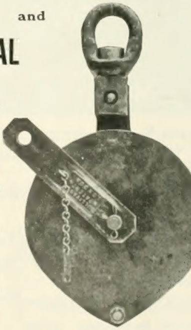

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Gresham Publishing Co., 34, Southampton Street, Strand, London, W.C.
Charles Griffin & Co., Ltd., Exeter Street, Strand, London, W.C.
New Zealand Mines Record, Wellington, New Zealand.

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H. J. H. King & Co., Nailsworth, Glos.

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Drum Engineering Co., 27, Charles Street, Bradford.
Enke, Carl, Schkeuditz-Leipzig, Germany.
Fairbanks, Morse & Co., 126, Southwark Street, London, S.E.
Fraser & Chalmers, Ltd., 3, London Wall Buildings, London, E.C.
Hathorn, Davey & Co., Ltd., Leeds, England.
Positive Rotary Pumps, Ltd., 23, Northumberland Avenue, London, W.C.
Tangyes, Ltd., Cornwall Works, Birmingham.

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William Asquith, Ltd., Highroad Well Works, Halifax.
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Thornycroft & Co., Ltd., J. I., Chiswick, London, W.
Yorkshire Patent Steam Wagon Co., Pepper Road, Hunslet, Leeds.

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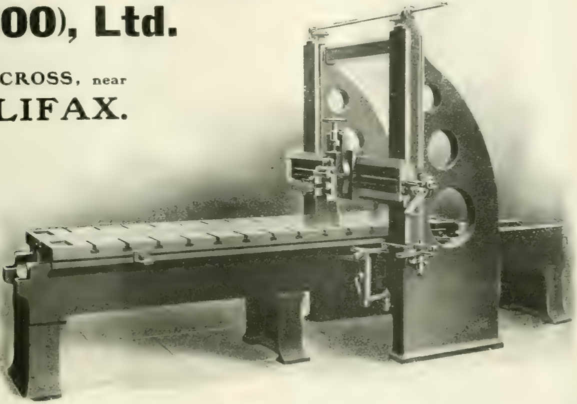

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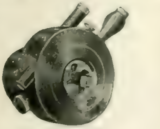

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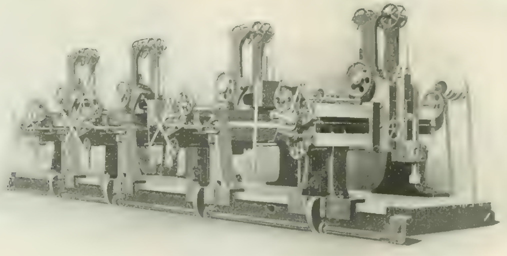

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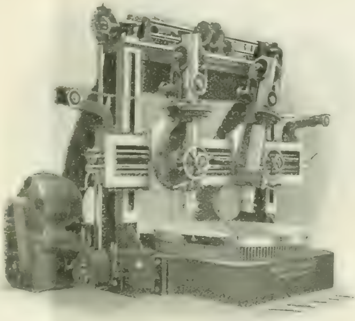

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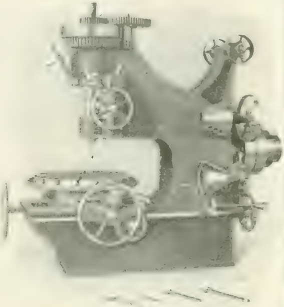

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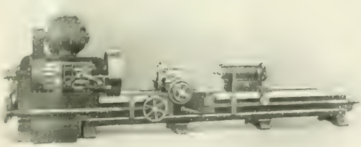

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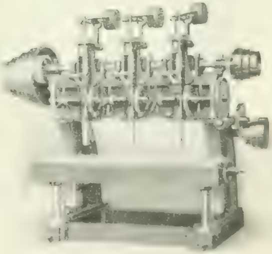

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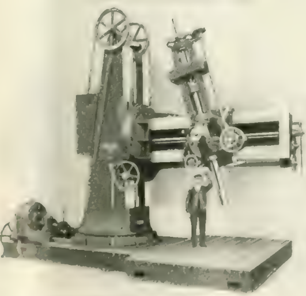

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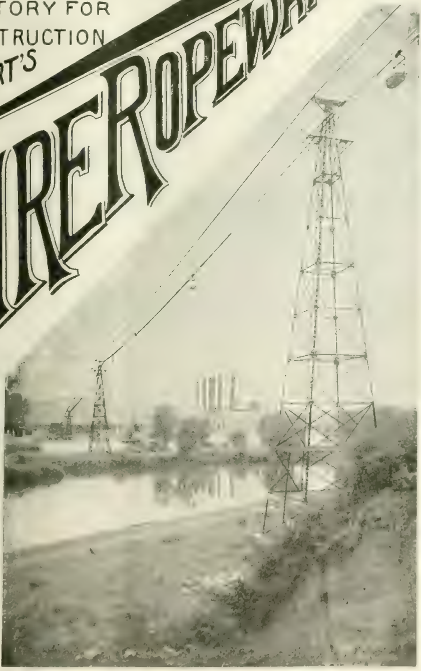

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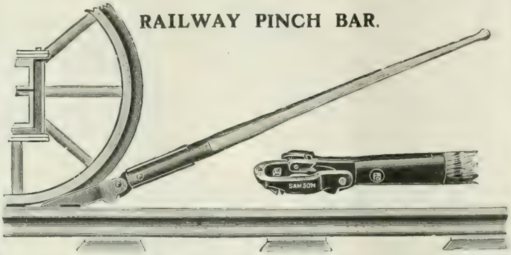

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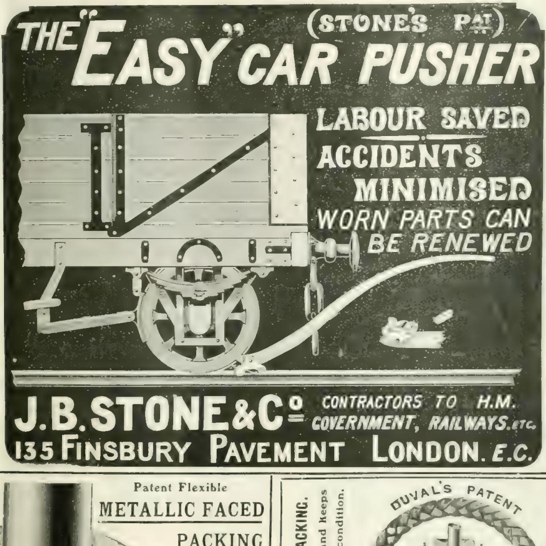

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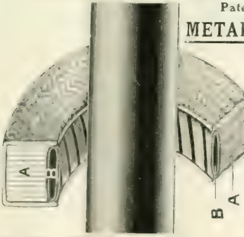

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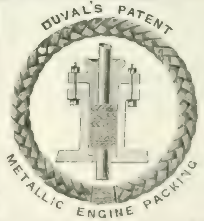

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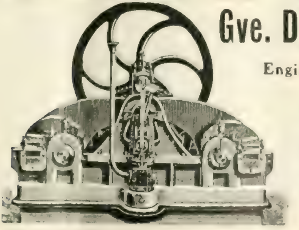

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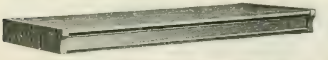
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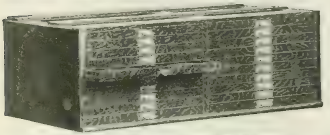
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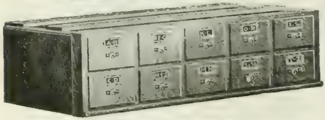
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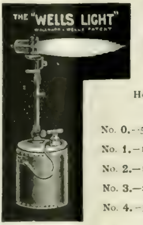

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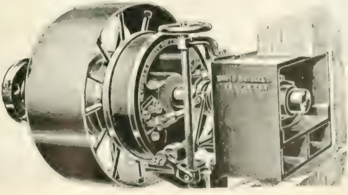

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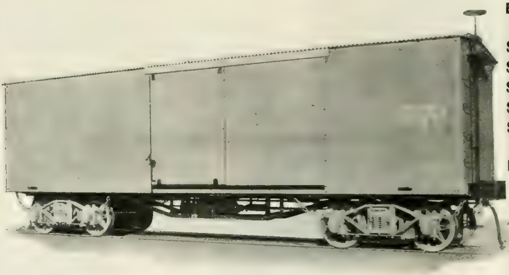

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PAGE'S WEEKLY

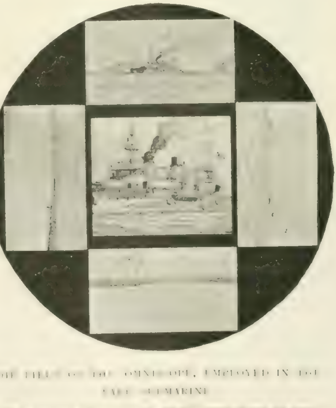
An Illustrated Technical Weekly, dealing with the Engineering, Electrical, Mining, Iron and Steel, and Shipbuilding Industries.

Vol. V. LONDON, FRIDAY, DECEMBER 2, 1904. No. 12.

The Offices of "Page's Weekly," Wednesday, Midnight.

THE great German strategist, Von Moltke, is credited with the assertion that he had fifteen separate schemes pigeon-holed for getting an invading army into this country, but he added—significantly—that so far as his knowledge extended, there was no possible way of getting it out again. The story is probably apocryphal, but it will serve our purpose, which is to point out that a somewhat similar state of things prevails in the cylinders of fast-running engines, namely, that it is perfectly easy to get the steam into the cylinder but extremely difficult to get it out again. The ideal system of steam distribution is, of course, that it shall enter at or near the boiler pressure; that it shall be maintained at or near that pressure up to the point of cut-off; that it shall be expanded down to the point when it ceases to be further useful as a propelling force; and then that it shall be summarily ejected.

This is where the difficulty comes in. Where independent exhaust valves with separate parts are used the problem is simplicity itself. You provide a valve or valves of sufficient area, and time their opening at your will. But when the functions of entrance and exit valves for both ends of the cylinder are performed by the ordinary flat slide valve, the impossibility at high speeds of getting one valve to do the work of four is very apparent. Nor is the difficulty lessened by the long steam passages necessary to bring the parts together under the one valve. To make these passages large enough to exhaust the steam with promptitude, would injuriously increase the clearance space. Hence the use in high-speed engines of piston valves, offering the advantages of short direct steam passages which may, without injury, be of large



THE FIELD OF THE OMNISCOPE, EMPLOYED IN THE LAKE SUBMARINE.

With [illegible] sketch [illegible] This [illegible] represents [illegible] magnification [illegible] centre [illegible]

THE LAKE SUBMARINE "PROTECTOR."

area, together with a greatly increased port-opening, equal in length to the circumference of the piston-valve.

This, however, is only a partial remedy, as anyone who will take the trouble to compare the indicator cards for any high-speed engine at half speed, and again at full speed, will discover. At the higher speed the exhaust cannot be got rid of in time and back-pressure is the result. Obviously an exhaust valve, entirely independent of the admission valve, is needed to secure the best efficiency. The highest piston speeds in use to-day, are those run off by locomotive engines, often exceeding 1,000 ft. per minute. Yet, with certain significant exceptions, flat slide valves are in general use.

We do not often see indicator cards from locomotive cylinders taken at these high speeds, but I fancy that a good case would be made out for the addition of a separate expansion-valve, working on the back of the main valve, thus leaving the latter available for exhaust purposes only, unaffected by the variations in the cut-off controlled, as now, by the driver. Whether the gain in efficiency would in the long run compensate for the additional complication introduced may be considered an open question at present. It is quite clear that the independent cut-off valves in the de Glehn compound locomotives and in the North-Western four-cylinder compounds, as recently modified by Mr. Whale, have affected wonderful results. Time will no doubt show.

Again, we have the results of Mr. Ivatt's experiments on the Great Northern on the comparative traction power of a 7-ft. 7½-in. single express engine with 19-in. by 26-in. cylinders, and an eight-coupled mineral engine with 4-ft. 8-in. wheels and 19¾-in. by 26-in. cylinders. The first named engines weighed 48 tons 11 cwt., with 17¾ tons on the driving wheels, while the latter totalled 54 tons 12¼ cwt., all available for adhesion. The results are taken from direct observations of the draw-bar pull of the two engines at the successive speeds shown in the table below. Approximate draw-bar pull in pounds at various speeds:—

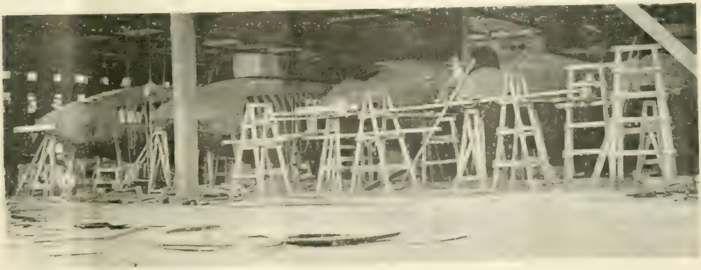
	Single Driver Express engine.	Eight-coupled Mineral engine
10 miles per hour	8,400 lb.	17,130 lb
20	6,832 lb.	10,102 lb.
30	5,712 lb.	4,810 lb.
40	4,704 lb	201 lb
50 ..	3,703 lb.	22 lb.
60	2,844 lb.	—
70	1,048 lb.	
80 .	104 lb.	
90	430 lb.	

It will be seen that at 10 miles per hour the small-wheeled engine had more than twice the hauling power of the express engine. At 27½ miles per hour they "tied." At 40 miles an hour the mineral engine transmitted no more tractive power than that registered by the single engine at nearly 100 miles per hour. At 50 miles per hour the pull was only 22 lb., and at 52½ miles per hour the internal resistance absorbed the whole power of the engines. The effective traction effort of the big-wheeled engine did not fall to zero until 100 miles per hour had been reached. I make no comment upon this instructive comparison of results, except to point out that in the case of the eight-coupled engine a very considerable proportion of the whole power of this gigantic machine when running at 52½ miles per hour was absorbed in simply expelling the exhaust steam from the cylinders.

In the last issue of the Journal of the United States Artillery, Mr. Robert G. Skerrett discusses the evolution of the submarine with special reference to the Lake type.* The article is the more interesting to British readers by reason of the increasing attention given to submarines in our own navy. According to this writer, Captain Lake has rendered his latest submarine so safe that it is hard to imagine any combination of circumstances that could or would be likely to render escape impossible, short of the total destruction of the boat.

The special precautions for safety which have been adopted by Captain Lake are summarised as follows :—

The boat when running submerged in suspension, has a reserve buoyancy of quite 300 lb. Should the motors stop, the craft would rise at once to the surface. Should a leak in any of the valves have permitted the entrance of enough water to destroy this reserve of buoyancy, and, should there be a failure of air pressure and the loss of that power of expulsion, electric pumps would supply the deficiency. Should these, however, fail, hand pumps could be used to drain the tanks fast enough to bring the boat to the surface where the gasoline engines could be started, and the pumps so controlled, of great capacity, would soon drain the tanks. If these should fail a 5-ton emergency, weight, set in the keel, could at once be detached, and should that fail, which is highly improbable, the two anchor



FIVE LAKE SUBMARINES FOR FOREIGN GOVERNMENTS.

In process of construction by the Newport News Shipbuilding and Dry Dock Co., Newport News, Va., U.S.A.

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* The Lake submarine *Protector* was described in detail in PAGE'S MAGAZINE for June, 1904.—ED.

weights, weighing together a ton, could be let drop on a run. Should, however, most of these fail, there is still the diving compartment as a means of escape, provided there were air enough in the low pressure system for the purpose. As a contributive to safety of no secondary importance is the boat's twin screws and dual power of propulsion, while as a minor phase of safety is mentioned the habitability of the *Protector.*

Considerable attention is devoted to Captain Lake's omniscope. This instrument, as the figure on page 733 shows, carries five lenses, and, with the omniscope pointed ahead, normal vision is given in the centre lens and reduced vision in the four smaller lenses or finders, which bear ahead and astern and on each beam. The field of the large lens is of 2 deg. and 40 min., while that of each of the smaller lenses is 21¼ deg. The main lens can be rocked so as to follow the horizon during slight changes of trim. The omniscope tube has a diameter of 6 in., is of rolled brass, and when housed lies 8 in. above the top of the sighting hood. The tube can be rotated. In looking into the eye piece, the observer sees a combination of five views similar in relative scope and size to those shown on the sketch. A quarter turn covers the entire horizon. In this an all-around power of observation is secured, while, by bringing the main lens to bear upon anything picked up in one of the four finders, normal vision and a judgment of the true distance of the object may be had.

The loss of the British *A* 1 was, continues Mr. Skerrett, primarily due to her faulty sighting instrument and its inability to give a means of properly judging distance, and the same may be said of substantially all of the observing instruments heretofore fitted on other submarines, both in America and abroad. By the official records, the American Government submarines of the Holland type have had a number of narrow escapes, and they have never been able to judge correctly the distance of the target under the most favourable circumstances. In the omniscope a series of cross-lines on the field of the main lens gives the observer a means of accurately measuring distance. When the observer is following a moving target, the movement of the omniscope is automatically transmitted to the helmsman. This is done by means of a cross line attached to a movable collar on the under-side of the compass, which, in turn, is actuated by a band passing around another collar on the omniscope. The effort of the helmsman, who cannot see without, is to keep the lubber line and this cross-line coincident, and so long as he does so a small buzzer sounds confirmation. The omniscope is swung in azimuth by the observer. No difficulty has ever been found in following a moving target, and the instrument has proved uniformly efficient and free from fogging. Ice, when forming on the outside, is easily removed by an ingenious arrangement that has proved entirely efficient during the past severe winter in the waters of Newport. Recent important modifications have added greatly to this remarkable instrument.

Some interesting reminiscences of student days, given by Lord Kelvin on Tuesday, upon his installation as Chancellor of Glasgow University, were followed by an admirable sketch of the history of the University, in the course of which it was shown that it has a reputation for progressiveness extending over two centuries and a quarter. Lord Kelvin remarked that during the last fifty years Glasgow University has grown in material greatness and in working power to an extent that its most ardent well wishers in the first half of the nineteenth century could scarcely have imagined possible. He proceeded to congratulate the city of Glasgow on having for her god-daughter a University splendidly equipped and admirably provided with workers.

PAGE'S WEEKLY

An Illustrated Technical Weekly, dealing with the Engineering, Electrical, Mining, Iron and Steel, and Shipbuilding Industries.

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Telephone No. [illegible] GERRARD.
Telegraphic and Cable Address: "SINEWY, LONDON."

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NEWS ITEMS.

Tube Developments.

The Great Northern Piccadilly and Brompton Railway Company will, in the ensuing session, apply for an Act authorising them to make various extensions. One branch line is to run from Knightsbridge to Chiswick; a second from Kensington to Acton; a third line will form a connection between the Chiswick and Acton routes. Powers are also being sought for other lines and connections, and the Act will contain clauses to enable the Company to make arrangements with the South Eastern and Chatham Companies with regard to a joint station at Ludgate Circus and traffic arrangements with the Underground Electric Railways, and the London United Tramways.

A New Departure in Electric Traction.

A somewhat unique departure from established methods in electric traction has, says the Railway and Engineering Review, recently been undertaken at Warren, Pa. The Warren and Jamestown Street Railway Company is equipping an alternating current single-phase electric railway system to operate between Warren, Pa., and Jamestown, N.Y., for which power will be supplied by gas engines operating with natural gas. The power station will be located at Stoneham, Pa., two miles from Warren. The initial equipment will consist of two Westinghouse gas engines, each of [illegible] b.h.p. capacity. They will be of the horizontal single-crank double-acting type, direct connected to [illegible] kilowatts Westinghouse generators furnishing current at voltage [illegible] upon the high tension transmission line.

Power Equipment

The power equipment was contracted for with the Westinghouse Company, who will specify the entire power and motor outfit. Natural gas will be used, furnished by the local distributing company. In this district the gas has a calorific value of about [illegible] B.T.U. per cubic foot. Transformer sub-stations [illegible] in number will be located along the right of way. These will receive the high tension current from the transmission line and reduce the voltage to such an extent as to render it more suitable for use in single-phase motors. The present motive power equipment will comprise four quadruple sets of Westinghouse single-phase motors, each approximately [illegible] h.p. capacity. [illegible] the company began experimenting with gas engines for power, with different [illegible] now exclusive adoption of gas engines for [illegible] power generation.

M'Aulay's Patent Forging Furnace.

A demonstration of the M'Aulay Forging Furnace took place recently at the Engine Works, Dumbarton, and during the trial, which lasted over three hours, two furnaces were at work, one shingling, the other making the slabs thus formed into a round shaft. In shingling, charges of five balls, weighing approximately 12¾ cwts., were experimented with, and from the time the furnace was charged until the balls were ready for the hammer forty minutes elapsed. In three and a quarter hours 37 cwts. of iron in slabs were produced on a consumption of 10 cwts. of coal, or 3·7 cwts. of shingled iron per cwt. of coal. In the above time three charges, each of five balls, were built, heated, and worked. In the other furnace a shaft 9½ in. diameter and weighing 15 cwts. was produced in the space of three hours on a consumption of 7 cwts. of coal, or fully 2 cwts. of iron per cwt. of coal.

Westinghouse Awards at the St. Louis Exposition.

In addition to the special award in the Department of Machinery for the best, most complete, and most attractive exhibit, no less than twelve grand prizes and twenty-five ordinary awards have fallen to the share of Westinghouse enterprises at the St. Louis exhibition.

The plant that secured this signal success comprises the stock products of the companies as follows: A.C. generators and motors, A.C. turbo-generator installation, static transformers and rotary converters, D.C. generators and motors, electric railway motors, A.C. and D.C. control systems for single and multiple unit operation, mining and industrial locomotives, horizontal gas engines and steam turbines, air brakes and friction draft gears, electric-car brakes, air-brakes and accessories for signal systems, development of mercury vapour lamps.

The gold medals received by the Westinghouse Companies are as follows: For complete A.C. and D.C. switchboards, Bremer arc lamps and arc lighting system, Nernst lamps, Cooper Hewitt lamps for photo-engraving, water and gas meters, electric measuring instruments, and for industrial betterment work, and the housing of the working classes.

Electric Driving in Cotton Mills

Messrs. Mather and Platt, Ltd., of Salford Iron Works, Manchester, have recently settled an important contract for the plant required for the electric driving of two cotton mills in Spain, which will be one of the largest and most complete installations of the kind.

The spinning and weaving mills, with adjoining dye and hosiery works at Malaga, in Andalusia, belong to the Marquess of Larios, who was a pioneer in starting Spanish manufactures. They are the largest in the country, and give employment to about 5,000 hands. Arrangements have lately been made by the Marquess for obtaining a supply of electric power from the Chorro Power Company, which has established a generating station in the Chorro gorge, some 50 miles north of Malaga. Power is transmitted by three-phase current at a pressure of 25,000 volts to a sub-station in Malaga, where the pressure is reduced to 2,500 volts, part of the energy being supplied to the Malaga electric lighting station.

37 m.m. Automatic Gun on Cone Mounting.

This gun consists of two portions, one of which is fixed, and is known as the non-recoiling portion, while the other is movable, and is called the recoiling portion.

The non-recoiling portion comprises the barrel casing or water-jacket, the breech casing, and the back block.

The construction of these parts is similar to that of the automatic rifle calibre gun, with the exception of the back block, which is fitted with a hydraulic buffer for controlling the recoil.

At the lower part of the back block and extending to the rear is the pistol grip containing the trigger-pull.

The other part of the gun recoils with the barrel and consists of a couple of plates attached to trunnions on each side of the barrel extending rearwards. The rear ends of the plates form bearings for a crank, the shaft of which projects through the outer casing. At the end of the crank is a volute spring, and at the other is a handle resting against a roller attached to the outer casing of the gun.

To the crank is attached a connecting-rod, and to this is linked the mechanism.

The barrel is surrounded by a strong spiral spring which returns the recoiling parts back in firing position after the recoil.

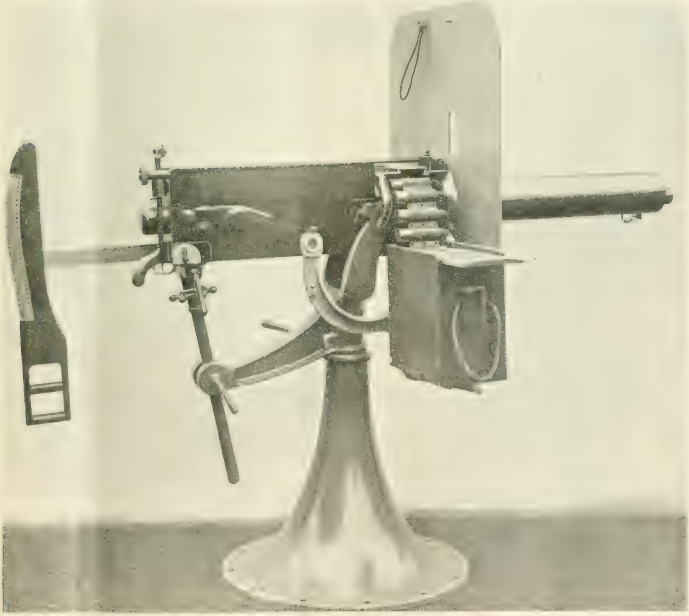
The gun is fed with cartridges from a belt placed in a box on the right-hand side of the gun.

The cone mounting consists of two separate pieces, viz., the cone and the crosshead. The cone is made in two parts, the cone proper and the pivot, which is riveted on to it, so that the two form one piece. The cone is bolted direct to the deck or platform. The crosshead, which slides over the pivot, carries the gun in trunnion holes secured by cap-squares. At the rear is the elevating arm, at the end of which is fitted.

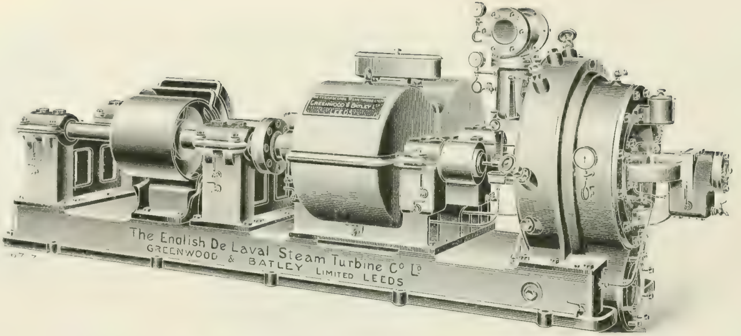
a metal bearing. Through a hole in the centre passes the elevating rack, the upper end of which is connected to the gun by the elevating joint-pin. On the left of this metal bearing are two screws, one on the upper surface to keep it from coming out of its recess in the elevating arm, and one at the end which projects into a longitudinal feather-way in the elevating rack, thus preventing the latter from turning. On the right hand of the metal bearing is a slot in which can slide vertically a locking-piece, the latter being provided with a series of teeth on one side corresponding with those on the right side of the elevating rack. A slight lateral movement can be given to the locking-piece by means of elevating clamping screw, which is so pitched that one complete turn of the right causes the teeth to engage firmly in the rack, and so fix the elevation, and one complete turn to the left withdraws the locking-piece clear of the rack, leaving the latter free to move up and down as may be required. Fine adjustment for elevation can be obtained by a hand-wheel at the upper end of the elevating rack.

The gun is clamped for traversing by means of a clamping bolt on the left hand side of the crosshead.

For the above details and for the accompanying illustration we are indebted to Messrs. Vickers, Sons and Maxim, Ltd., the makers.



37 M.M. AUTOMATIC GUN ON CONE MOUNTING.
By Messrs. Vickers, Sons and Maxim, Ltd.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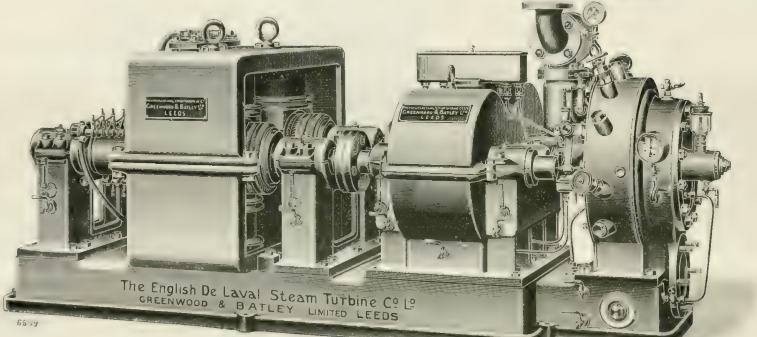
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APPLICATIONS OF THE DE LAVAL TURBINE.

(1) A 225-b.h.p. De Laval Steam Turbine Motor. (2) 75 b.h.p. (50 k.w.) Turbine Dynamo.

THE DE LAVAL STEAM TURBINE.

(*Continued from page 685.*)

IN our last issue reference was made to the successful system, recently described in detail by Machinery which is employed at the De Laval works in giving out drawings to the workmen.

The turbine parts are marked with a number designating the particular part, prefixed by a letter for the size of the machine. Each drawing is devoted to a single part and bears the same character as that part. A board hung in the tool room contains a large number of pins having numbers corresponding to those of the turbine parts. When a workman hands in his check for drawing R-126, for example, it is hung on pin 126 and a small metal clip, lettered R, is slipped over the edge of the check. The number on the check shows who the workman is; and the clip, together with the number of the peg on which the check hangs, shows what drawing has been given out.

APPLICATIONS OF THE DE LAVAL TURBINE.

De Laval steam turbines are chiefly employed for driving electrical machinery, though they are applicable to almost all classes of work, where other steam motors are used. The various units are self-contained. They are mounted on a one-piece sub-base and are directly connected by means of flexible couplings, the entire unit being assembled in the shop, and operated before being shipped.

This arrangement, which obviates any uncertainty as to turbine and generator fitting together in a proper manner and also takes up a minimum amount of floor space, is perhaps the most characteristic feature of the De Laval generator.

All units from 50 to 200 k.w. inclusive, consist of two generators mounted side by side and geared together by means of turbine pinion and two gears, these sizes being well adapted for factory purposes, as they can be used either on two or three-wire system, running two voltages from the same unit, or running motors at one voltage and lights at another.

De Laval alternating current units are made in sizes of 75, 100, 150 and 200 k.w., 50 cycle, single, two or three-phase, and with voltages varying from 220 to as high as may be required on machines of these capacities. Machines of 25 cycle are also produced, but require different size generators, and are somewhat special in their construction.

Another field in which the De Laval turbine is playing an important part is in connection with the driving of blowers. A good deal of attention has been given lately to the De Laval direct connected turbine blower, with the result that the firm are able to announce an important advance in this direction.

While most of their blower sets heretofore built have been for high pressure work, and have been mainly used in gas works, they are now being produced for almost any pressure from 5 in. to 21 in. and from 7 h.p. to 300 h.p. The turbines are made to operate either condensing or non-condensing and on steam pressures varying from 50 lb. to 200 lb.

Employment for the De Laval turbine is also found in the operation of centrifugal pumps, a series of pumps of improved mechanical construction having been designed to admit of the high speeds necessary, while at the same time enabling the pumps to work against high heads. It also finds an important use as applied to marine lighting sets and train lighting equipments.

By the courtesy of Messrs. Greenwood and Batley we illustrate on the opposite page some typical applications of the De Laval turbine as a generator of electric power.

MOVING COIL INSTRUMENTS FOR DIRECT CURRENTS.

WE have received from Messrs. Crompton and Co., of Chelmsford, a copy of a pamphlet which they have just issued, describing their moving coil instruments for direct currents. Our readers may remember that in the discussion following a paper read before the Institution of Electrical Engineers last summer, the system of standardising ordinary commercial instruments in such a way as to enable engineers to verify their own instruments with ease, was described by Colonel Crompton. The pamphlet under consideration deals at length with this particular point.

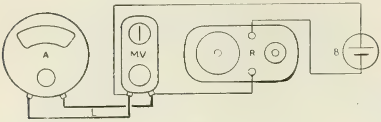


FIG. 1.

Hitherto it has usually been beyond the resources of electrical engineers to verify instruments calibrated to read high voltages or large currents, since the stations are not usually equipped with facilities for such measurements. It appears, however, that if the parts of the apparatus are standardised separately it is quite easy to verify by extremely simple appliances those parts which are alone liable to error, and it seems probable that some such system as is proposed in the pamphlet under review must inevitably come into use when its application is more generally understood.

Taking the amperemeters first, Messrs. Crompton and Co. adjust the resistances of all the shunts of their instruments to exact values, the value in each case being such as will give a P.D. of ·075 of a volt when the full current is passing which the shunt is rated to carry. The shunts are, in fact, standard resistances of a value in each case .075÷C ohm where C. is the rated current. The indicating instrument is now employed to indicate the small P.D. of the shunt, and may be regarded as a millivoltmeter reading up to ·075 of a volt. The whole of the amperemeters manufactured by Messrs. Crompton and Co. are provided with two scales. One scale—being the most conspicuous of the two—is figured to indicate the currents passing through the shunt, but below this are marked in small figures a few points on a scale of millivolts. It is by verifying this latter scale that the accuracy of the indicating instrument is tested. Assuming the shunt to be correct (and well made resistances can be trusted to retain their value spermanently); the verification of the indications of the millivolts is all that is necessary.

For the voltmeters the resistance of the circuit is adjusted in every case to such a value as will pass a current of 15 milli-amperes at the normal reading. Suppose, for instance, the voltmeter were an open scale instrument reading about 450 volts, the total resistance of the instrument circuit would be 30,000 ohms. The indicating instrument carries a small scale of milli-amperes as well as the larger scale of the volts it is intended to measure, and the terminals are so arranged that the testing current can be passed through the moving coil cutting out the resistance.

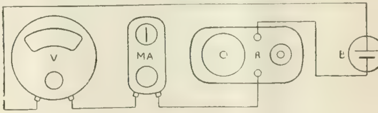


FIG. 2.

One Leclanche cell is quite sufficient to test both the amperemeters and the voltmeters and in figs. 1 and 2 are shown the connections for these operations. In each case B is a single cell and R is a rheostat for continuously adjusting the resistance of the circuit. The instrument, which in one diagram is marked M.V. and in the other M.A., is a small indicator or gauge having a resistance of 5 ohms whose pointer is deflected exactly to a single fiduciary mark when either the current of ·015 of an ampere passes through it, or an E.M.F. of ·075 of a volt is applied to its terminals. By regulating R. until the gauge is brought to this mark, it will be seen that the reading of the instrument under test is immediately checked.

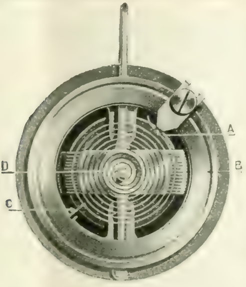


FIG. 3.

In addition to working out this plan for testing the instruments, provision has been made for small adjustments, should such be required.

Each movement is fitted with a single controlling spring which is seen underneath a small circular glass cover on the face of the instrument. This glass is secured by a split ring which can be removed without unfastening any screws, giving access to the controlling arrangement. The end of the controlling spring is attached to a movable ring by turning which, the position of the pointer can be adjusted. The attachment of the end of the spring to this ring is made by means of a small screw, and by loosening this the effective length of the spring can be altered. The whole of the adjustments of the instrument are made on this point in course of manufacture, and they can be repeated at any time subsequently without opening the instrument case or touching the connections. The second of the two adjustments is rarely required, but the advantage by the first adjustment of being able to set at any time an open scale voltmeter to its exact reading will readily be appreciated.

On their own switchboards, we are informed, Messrs. Crompton and Co. verify the whole of their instruments in position without the slightest difficulty and with great rapidity.

Fig. 3 shows the view of the adjusting spring and its mountings. We cannot explain fully here all the details of the construction of the movement, but we may notice one interesting point, that is, that the current is carried into the moving coil through thin flexible ligaments instead of through the controlling springs, which has been the usual practice hitherto. Fig. 4 shows the construction of these. Simplification is obtained by omitting all small insulators and soldered connections from the controlling spring.

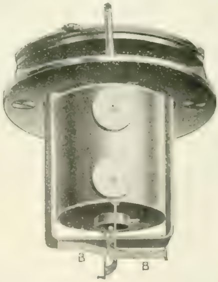


FIG. 4.

There is no particular novelty about the cases of the instruments. They are of a simple character and seem to be neatly worked out, and the pamphlet contains the usual dimensioned diagrams giving their exact dimensions and the positions of the holes required for mounting them.

OUR WEEKLY BIOGRAPHY.

MR. ROBERT HAMMOND, M.I.E.E., M.Inst.C.E., M.I.Mech.E.

MR. ROBERT HAMMOND, the well-known consulting electrical engineer, was born at Waltham Cross, Herts, in 1850. Educated at Nunhead Grammar School, he subsequently obtained his engineering training at Middlesbrough.

From the commencement of his professional career, Mr. Hammond always displayed a great interest in electricity; he was prominently associated with the early progress of electric lighting, having in 1878 taken up electrical engineering in connection with the works established by him in London and Middlesbrough. Appointed first concessionaire of the Brush Company, he was, to a great extent, responsible for introducing the Brush Arc Machine into England, and installing it in a number of the principal iron and steel works in the United Kingdom.

In 1880, after the invention of the incandescent electric lamp by Sir J. W. Swan, Mr. Hammond devoted considerable time to central station lighting, and was responsible for the equipment of the first English works, where electricity was distributed from a centre for incandescent lamps by high tension. These undertakings, which were carried out at Brighton, Eastbourne, and Hastings, were afterwards acquired by the respective corporations.

Mr. Hammond's interests were not restricted to one sphere of electrical industry: in 1883 he published a work entitled "Electric Light in our Homes," the first book dealing with the electric lighting of private residences. The author claims that his house at Highgate was the first to be illuminated throughout with incandescent electric light.

The training of the young electrical engineer is a question in which Mr. Hammond has always taken a keen interest, and in 1884, with a view to affording a practical solution of this complex problem, he established the Hammond Electrical Engineering College. His interest in this matter was further demonstrated in 1890, when, acting on his counsel, the Board of Control founded the Electrical Standardising, Testing, and Training Institution, known popularly as Faraday House.

Mr. Hammond has paid frequent visits to the United States, in order to inspect the principal electric light works situated between New York and San Francisco, and for the purpose of studying the developments in electric traction. He has also made a special study of electricity in its application to tramways and light railways, and has issued many important reports on the subject to local authorities.

During recent years Mr. Hammond has specialised in central station work. He is responsible for the construction of the electricity supply works at many important centres at home and abroad. Since 1893, in all cases he has acted solely as consulting engineer, but prior to 1893 in a few instances he also accepted the responsibilities of contractor. At the end of 1893 he retired from contracting to devote himself exclusively to consulting work. The value of the electrical engineering work carried out under Mr. Hammond's supervision amounts to about three millions sterling.

Mr. Robert Hammond is a member of the Institution of Civil Engineers, a member of the Council of the Institution of Electrical Engineers and its honorary treasurer; he is also a member of the Institution of Mechanical Engineers.

MR. ROBERT HAMMOND, M.I.C.E., M.INST.E.E., M.I.MECH.E.

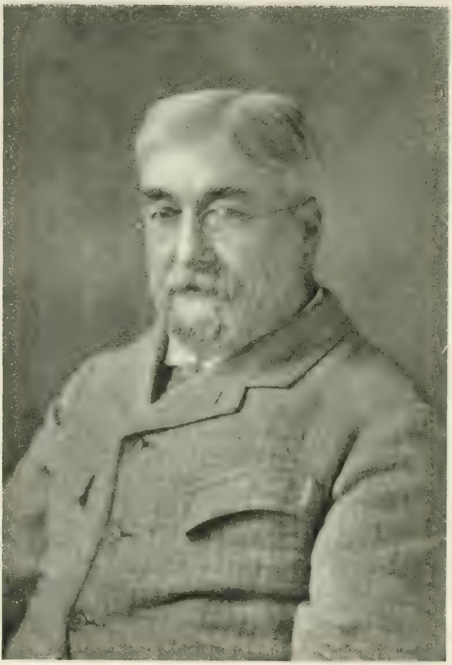


Photo by Elliott and Fry.]

SIR NORMAN LOCKYER, K.C.B., F.R.S., LL.D.,

Past President of the British Association for the Advancement of Science, Director of the Solar Physics Observatory South Kensington. Born at Rugby, May, 1836, educated privately and on the Continent Received War Office Appointment, 1857; Editor of Army Regulations, 1865. Four years later was elected Fellow of the Royal Society. In 1870 he was appointed Secretary of the Duke of Devonshire's Royal Commission on Science, and in 1875 was transferred to the Science and Art Department He was Rede Lecturer at Cambridge in 1871, and has seven times been Chief of the English Government Eclipse Expeditions.

NAVAL NOTES.

THE JAPANESE ARMOURED CRUISER "IDZUMO."

Which was with Admiral Kamimura's Squadron, when he defeated the Vladivostock Cruisers.

Length, [illegible] Beam, 68 ft. 6 in. Draught, 24 ft. 3 in. Displacement, [illegible] tons. Coal Capacity, [illegible]. Engines: four-cylinder, triple expansion, by Humphrys and Tennant, Belleville boilers. Armour: Complete Krupp Steel Belt, [illegible]. Citadel [illegible]. Barbettes and gun houses, [illegible]. Conning tower, 14 in.; Casemates, [illegible]; Deck, [illegible]. Armament: four 8-in. quick-firing guns, in pairs in barbettes; fourteen 6-in. quick-firing guns, ten in casemates, four on upper deck; twelve 12-pounder quick-firing guns; seven 3-pounder quick-firing guns. Torpedo tubes, four, submerged.

FRANCE.

M. Charles Bos is the reporter of the French navy Budget this year, and a forecast of his proposals has been made public in the French press. He considers one of the principal lessons to be derived from the war in the Far East to be the uselessness of battleships with a heavy armament but low rate of speed and small coal capacity. For this type of vessel he would like to see substituted cruisers of the same tonnage but with less armour and a far larger coal carrying capacity, and these vessels should be able to steam from Algiers to Cochin China without coaling, even if they had to go by the Cape route. He would also have a smaller type of vessel built for home service, but both classes should be able to take their place in the line of battle. These vessels, moreover, instead of carrying guns of seven different calibres should be supplied only with [illegible] in., [illegible] in., and 2·5 in. pieces.

Another remarkable proposition which is foreshadowed concerns the dockyards. M. Bos suggests that the shipbuilding yards engaged on Government work should be reduced to four—two Government and two private yards. To keep one such establishment open, he says, four large vessels must be under construction at various stages of progress, and this would mean having sixteen large warships under construction each year. Taking the cost of a ship at £1,400,000, the yearly expense would be £[illegible] for large ships only, at least another £[illegible] would have to be allocated to the construction of small craft, and this would bring the annual expenditure on new construction to £[illegible], or £[illegible] more than the sum at present allowed for that purpose. Whether the suggestions of M. Bos will meet with the support of the French Chambers remains to be seen.

GERMANY.

The naval estimates for the year 1905 as suggested in reports from semi-official sources total £11,920,000 (M. [illegible]). The recurring expenditure is estimated at £[illegible] (M. [illegible]), an increase on £[illegible] (M. [illegible]) over the previous estimates, and the non-recurring expenditure at £[illegible] (M. [illegible]), of which latter sum £3,[illegible] (M. [illegible]) is to be devoted for new construction, and is to include first instalments for the battleships O and P of the naval programme, one large and two small cruisers, a gunboat for foreign service, a river gunboat and a mine-laying vessel. There is also reported to be a sum of £[illegible] (M. [illegible]) devoted to experiments with submarines.

The [illegible] trials of the [illegible] having prove altogether satisfactory, she has since her commissioning carried out further experiments, with the result that at natural draught the indicated horse-power was 10,465, while at forced draught it touched 14,300. The speed at this last figure was exactly 19 knots.

The *Braunschweig*, the name ship of the class of vessels which immediately follow the *Wittelsbachs* in point of age, has already been in commission some little time, and at the beginning of November the second vessel of the class, the *Elsass*, was delivered by the Schichau firm, having been hurried forward to completion immediately after the North Sea incident. The completion of these vessels does not merely mark the addition of two new battleships to the German active squadron. The *Braunschweig* and the *Elsass* belong to the programme of 1901, and it is the fact that they have hoisted the pennant for their maiden commission before all the trials of the three vessels which were commenced at the same time for the British Navy are complete. That must be kept in view by naval writers in this country. Thirty-six months is ample time for the completion of battleships. It has been done in less time before now, and at this period of the world's history we cannot afford to lose ground.

The launch of the *Deutschland* at Kiel on November 19th was the occasion of a speech from Count von Bülow, in the course of which he made a remark which deserves to be recorded. He said that German naval defences were a challenge to no one. This the Times calls the "authentic interpretation" of certain remarks of more exalted origin which have aroused much feeling in this country on various occasions. The list of these phrases which the Times has collated makes very remarkable reading, but there is one missing. Is not the phrase "Our future lies on the water," of German origin?

It is reported that a large cruiser of [illegible] tons is about to be commenced at Weser.

UNITED STATES.

Mr. Paul Morton's remarks at a banquet in New York recently, have quickly received confirmation He said: "Be assured that you have in the White House now a man who believes in having the best and strongest navy in the world." This week it has been announced from the department of the Secretary of the Navy that the estimates for 1905 will total £22,906,127 ($114,530,658) an increase of £3,494,489 ($17,372,448) over the sum voted for the past year. I have already given particulars of the building programme for next year. It only remains to add details of the plans for the scouts *Chester*, *Salem*, and *Birmingham* which have been approved by the Secretary. The length is to be 424 ft., breadth 46 ft. 8 in., draught at full load 18¾ ft. displacement 4,310 tons, n.h.p. 16,000, speed 24 knots, armament twelve 3-in. guns, and two submerged torpedo-tubes. The amount of ammunition carried is to be 3,600 rounds, and eight torpedoes. There will be light protection for the vitals. The complement is to be 384 officers and men.

The battleship *New Jersey* was launched on November 10th at the works of the Fore River Ship and Engine Company. The *New Jersey* is of the *Georgia* class, and is the last vessel of the class to take the water. The launch was successfully carried out, the naming ceremony being performed by Mrs. Kinney, daughter of the Governor of New Jersey.

MINOR NAVIES.—SWEDEN.

A correspondent sends me the following particulars about the Swedish navy to supplement my note last week. There are three armoured gunboats, and a submarine building, in addition to the vessels previously enumerated. These four vessels are expected to be completed by the end of the present year, as well as the t.b.d. of the *Mode* class. When they are finished the composition of the Swedish navy will be: Twelve armoured coast defence ships, four monitors, seven armoured gunboats, five t.g.b.'s, ten gunboats, two t.b.d.'s, 31 t.b.'s, eighteen of the first class, and, various out of date vessels in use as training ships or other auxiliaries.

The Swedish Naval Budget for 1905 totals £891,725, and it is hoped that the present building programme will be complete by 1907.

NORWAY.

The Naval Budget for 1905-6 totals £[illegible],277 ([illegible]). Two new torpedo-boats, the *Orn* and *Ravn*, have completed their trials making 23·5 and 2[illegible]·5 knots respectively.

BRAZIL.

The new programme, to which reference was made a week or two back, is being brought into effect. The twenty-eight vessels contemplated are to be completed by 1914, and it is expected that the majority of the vessels will be built by Messrs. Vickers, Sons and Maxim, of Barrow, and Messrs. Armstrong, Whitworth and Co., Newcastle. The battleships are to be built on similar lines to the *Triumph*, and will be armed with Armstrong guns. The armour-plating is to be of the "Maxim improved" kind.

THE BONZANO RAIL JOINT.

IT is somewhat remarkable that while the weight of rails for permanent way has crept up from 60 lb. to 90 lb., and, in some cases, even 100 lb. per yard, with the object of attaining greater strength and resistance against wear and tear, the joints or fish plates for uniting rails have hitherto fallen very short of approaching the strength of the rail itself; they form, in fact, a weak link in a strong chain, many of the ordinary angle-splices or joints being about one-third the breaking strain of the rail.

The accompanying figures illustrating the Bonzano Rail Joint, explain definitely the inventor's claim that it is greater in strength than the rail itself. Briefly stated, it is an improved rail-joint, which will act as a truss bridge piece between the sleepers to support the rails, and in which the rails are held in suspension by the plates making the joint.

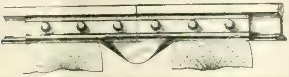


Fig. 1.—Side view of Bonzano joint, as used on the main line of the Pennsylvania Railway—100-lb. rail.

It will be seen from the diagrams that a substantial joint plate is provided, the joint forming the truss bridge piece between the ties or sleepers to support the ends of the rails. The device is especially applicable for use in connection with double-headed rails, the feet giving the rail the necessary wide bearing, and it can be used, if necessary, as a chair for supporting the body of the rail.

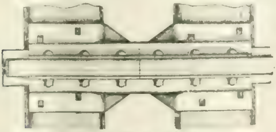


Fig. 2.—Plan of ditto.

Fig. 1 is a side view; fig. 2 a plan; and fig. 3, a perspective view of one of the joint plates. The sectional view (fig. 4), illustrates an ordinary angle splice bar, with Bonzano additions shown in black.

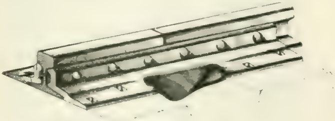


Fig. 3.—Perspective view of the joint.

The depending flange and webs forming the truss structure can be economically manufactured, as the parts are simply rolled, cut into lengths, and the depending portion pressed from the lateral flange. It is coupled to the rails in the ordinary manner, and the feet can be secured to the ties or sleepers, either by spikes or screws, as desired. One of the severest tests to prove the strength of the Bonzano joint was made by taking a 100-lb. rail and by hydraulic pressure slightly bending a parabolic curve upon it. It was found that the attachment and subsequent screwing up of two joints served to straighten the rail.

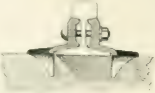
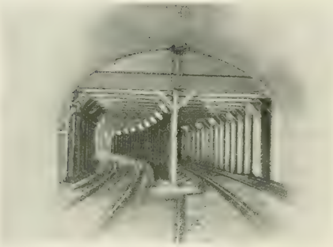


Fig. 4.—Ordinary angle splice with Bonzano additions shown in black.

A large number of railway accidents are attributable to faulty joints. Although not a frequent cause of derailment, they are a perpetual cause of costly wear and tear to the rolling-stock. The Bonzano Joint Rail by reason of its increased strength necessitates far less care and attention given to permanent way.

Messrs. Cammell, Laird and Co. have made a large quantity of these joints for export, and are now considering the best means of manufacture for home railways. The patent rights are being dealt with in Great Britain by Mr. A. Ronald Tree, of 4, Lloyd's Avenue, London, E.C.



TYPICAL SECTION OF SUBWAY.

POWER FOR THE NEW YORK SUBWAY.

THE Allis-Chalmers Company of Milwaukee, Wis., U.S.A., have just issued an elegantly printed booklet, descriptive of the part which the company has played in providing the power required for the recently opened New York Subway.

The 5,000-h.p. Allis-Chalmers' engine combined with a Bullock electrical generator which earned for itself the title of "Big Reliable" at St. Louis constitutes the type employed for the subway.

The subway engines are the largest yet built. Each is rated nominally at 8,000 h.p., but its actual capacity is 12,000 h.p. The nine engines forming the plant have an aggregate power equal to the combined power of half a dozen great steam ships.

Each of the engines has a battery of six powerful boilers to feed it. These, like everything about the engines are arranged so that nothing conceivable, short of an earthquake or a failure to get fuel, would be able to stop the operation of the power of the subway. The pipe lines which lead from each battery of boilers to its engine are connected to a set of three 12-in. pipes in such a way that any engine may be supplied with steam from either of the boiler groups. The valves for opening these connections are operated from the engine-room, where, in case of accident, the operators would be protected from escaping steam by a heavy wall.

The following details of the engines will be found interesting :—

Shafts: Hollow-forged open-hearth steel, 16-in. hole; diameter, generator fits 37 in., main bearings 34 in., crank hubs 30 in. Weight, each, 62,700 lb.

Cranks: Fan-tail type, cast steel. Weight per pair 64,000 lb.

FIVE OF THE ALLIS-CHALMERS' 12,000-H.P. SUBWAY ENGINES.

Seen from the low pressure vertical cylinder side

Total revolving parts on each engine, [illegible] lb.

Piston Rods: High-pressure diameter [illegible]. Low-pressure diameter 10 in.

Crank Pins: Nickel steel diameter [illegible]

Steam Ports: High-pressure, area 142 square inches Low-pressure, area, 583 square inches.

Exhaust Ports: High-pressure, area, [illegible] square inches. Low-pressure, area, 733 square inches.

Exhaust Pipe: Diameter [illegible] square inches.

Cylinders: High-pressure, horizontal; double-beat poppet valves in the heads; diameter [illegible] in. Low-pressure, vertical; side pipe construction, valves in heads, [illegible] single-ported valves, double ported diameter, [illegible] in.

The subway engines are in twins. Each of the nine engines consists of two parts connected to a single shaft by a crank at either end of the shaft. Each part has a high-pressure cylinder lying horizontally, and a vertical low-pressure cylinder. Both cylinders are connected to a single crank pin. The cranks at the opposite ends of the shaft are set at different angles thus securing a turning movement of great uniformity.

The daily average output of the nine engines is about 800 000 kilowatt hours.

The power of the subway is not confined to the important work of driving the trains. At the lofty station on the Manhattan viaduct it keeps in motion moving stairways to take passengers up and down, while at the sunken stations along Washington Heights it operates electric elevators for a like purpose.

DETAILS OF SUBWAY SCHEME.

The following paragraph enables one at a glance to grasp the enormous extent of the subway scheme and will be found useful for purposes of comparison

Contract signed to build and operate the road, February 21st, [illegible].

Ground formally broken by Mayor Van Wyck in front of the City Hall, March [illegible].

[illegible]

Work actually begun, about September 1st, 1900.

Legal date for completion, August 21st, 1904.

Formal opening to the public, October 27th, 1904.

Cost: Contract price for building, $35,000,000; allowed by city for real estate, etc., for terminals and land, $1,750,000.

Equipment: Paid for by the contractor power house engines wiring sub-stations, cars, etc. estimated, $15,000,000.

Excavation, 3,100,000 cubic yards; earth, [illegible] cubic yards; rock, 1,170,000 cubic yards; rock tunneling 305,000 cubic yards.

Length, 24·7 miles; underground, 19 miles; elevated structure, 5·7 miles; four-track section, 6·7 miles; three-track section 7·4 miles; two-track section 10·6 miles; switches and sidings, 5 miles; total length of track, 70 miles.

Stations: 49; 12 on elevated structure 37 underground; 5 are express stations.

Motor Cars: Each provided with two 200 h.p. motors, one on each track.

Express trains: 8 cars; 5 motors cars 3 trailers.

Local trains: 5 cars; 3 motor cars, 2 trailers.

Highest speed: Of express trains 50 miles an hour.

Average speed of express trains 30 miles an hour.

Highest speed of local trains 35 miles an hour.

Average speed of local trains, 16 miles an hour.

Traction rails: 100 lb. of the yard. Third rail for electric current, 75 lb. to the yard.

Nine sub-stations: For rotary converters.

Electric current: 11,000 volts, 3 phase 25 cycles stepped down to 625 volts.

CITY HALL TO BROOKLYN EXTENSION

Cost, $10,000,000.

Length, 3½ miles.

Length of river tunnel 1·2 miles.

Eight stations: four in Manhattan and four in Brooklyn.

CALENDARS.

Messrs. W. Summerscales and Sons, Ltd., remind us that the calendar season has already set in. They forward a substantial circular wall calendar [illegible]. The days of the month are set out in a square white panel and the words "W. Summerscales and Sons, Ltd., Keighley" are effectively rendered in blue on a silver ground, while at the sides of the square are [illegible] reminding us that the firm's specialities are [illegible] high-class laundry machinery, and [illegible].

LAUNCHES.

At the 30 hours' trial of the battleship *King Edward VII.*, at four-fifths of her steam-power, the engines developed a total i.h.p. of 12,884, and attained the mean speed of 17·5 knots. She has since successfully undergone the eight hours' full-power trial, and the anchor and circle trials.

The cruiser *Diamond*, which was launched in January last by Messrs. Cammell Laird and Co. has now left the Mersey for the Clyde to undergo her steam trials.

There has just been launched from Messrs. Swan, Hunter, and Wigham Richardson's yard at Wallsend-on-Tyne, the turbined-engine yacht *Albion*, designed by Sir William White, and built to the order of Sir George Newnes, M.P. The *Albion* is a sea-going yacht of a little over 1,300 tons, with a length all over of 270 ft., with 34 ft. beam and 20 ft. moulded depth. The engines, with cylindrical boilers, have been constructed on the Parson system at Turbinia Works and are calculated to give smooth-water speed of 15 knots.

The "Strasburg Post" reports that the sea-going torpedo-boat No. 125, the first German torpedo-boat to be fitted with turbines, has undergone her trials most successfully at Elbing.

The *Kennet* torpedo-boat destroyer, which is being built at the works of Messrs. Thornycroft at Chiswick, has during the past week been undergoing her trials at Weymouth.

The battleship *Deutschland*, launched at Krupp's Germania Yard, Kiel, on November [illegible]th is the first of the new "N" class in the German navy.

Submarine B1, which was launched from the yard of Messrs. Vickers Sons and Maxim early in November, has been undergoing some very exacting trials in deep water outside Barrow Harbour. She is a new type in this class of craft, being longer and of greater girth than the A class, and possesses many improvements which have been suggested by the experts as a result of the experiments which have taken place in the last-named group of submarines.

The French submarine "A[illegible]" has been successfully launched at Cherbourg. The vessel is of the same type as the *Naiad*, with the exception of the stern, which is shaped like a whale. The "A[illegible]" will have a speed of 8 knots, the motive-power being electricity.

QUESTIONS OF THE DAY

III.—The National Encouragement of the British Inventor: How Can it be Secured? *(Continued from page 662.)*

This discussion was initiated by Mr. B. H. Thwaite in Page's Weekly for October 28th. Inventors and others interested, who have not yet stated their views, are invited to do so, in order that the discussion may have a practical outcome.—Ed.

AN INVENTOR'S VIEWS ON PATENT LAWS.

[illegible] Northampton Buildings,
Clerkenwell, [illegible]

To the Editor of Page's Weekly.

Sir,—As the questions might be asked, "Who and what is an inventor? And why should he have privileges?" it seems best to first deal with these questions.

Inventors may roughly be divided into three classes.

1. The person with a happy idea which he thinks worth protecting. A patent is obtained, but little or no experimenting is done, and no investigations are made to ascertain its validity or commercial value. His inventive ingenuity is exhausted at the first attempt and no more is heard of him.

2. The genius who patents anything and everything. The dreamer of dreams and the [illegible] of patent agents. Among his inventions are the flying machine and the perpetual motion machine.

3. The inventor, the man who makes inventing more or less his profession, who tackles some practical or mechanical problem, who, industriously and steadily, for many weary months, perhaps years, works, devises experiments, making and remaking the apparatus, who perhaps succeeds in the end, taking care to find that, owing to an [illegible] patent law, the result of those weary years of patience, all his time and capital is lost to him for ever. Who has [illegible] before, year by year [illegible] again and again, [illegible] his final resting-place in Park Lane or the workhouse.

DRASTIC CHANGES TO THE DISADVANTAGE OF PATENTEES.

Those inventors were hoping that the new patent act would do something to assist them in their arduous and, in many cases, unremunerative labours, but so far from this being the case the new Act makes drastic changes to their disadvantage.

The changes made are that a practically useless examination will be made, for which the inventor must pay increased fees. That the too short period of nine months allowed between the filing of the provisional and the complete specification is reduced to six months only. These two alterations, with some rules for the granting of compulsory licenses, comprise the much vaunted new patent act. It is hard to understand why these alterations in the law were made. The committee appointed to inquire was composed of two from the patent office, one from the Board of Trade, one [illegible] under section [illegible] of the Act [illegible] three consumers of patented articles, one legal expert, seven patent agents and one inventor. [illegible] but one [illegible] of [illegible]. The new Act should be called the patent agents' act. [illegible] it will cause the inventor, it is [illegible] that it will increase the cost of obtaining a patent at least [illegible]. [illegible] the patent [illegible] must be [illegible] is a [illegible]. [illegible] invention [illegible] patent. [illegible] Mr. [illegible] G. W[illegible] and the magazine spools were placed in juxtaposition. In bringing the film into the camera the film was unwound from the two spools, but after exposure it was rewound on one spool only. A spring dark blind came down between the loop of film at each exposure.

Automatic perforators were concealed in bar or carrier between the loop of film, automatically perforating the film the size of the picture taken. Provision was made to take either half or full-size pictures interchangeably. An indicator was constructed to register the quantity of film exposed even when the size of the pictures was taken interchangeably. The film required no backing marks or numbers. This apparatus was taken as one invention, but under the new rules there would be no difficulty in dividing so small a thing as a photograph camera into six separate patents and an ingenious expert would probably discover a few more.

INCREASED COST.

The results of the new examination will be that the inventor must pay one pound increased fee; that in the course of the examination reference to various specifications, will be made, necessitating, many interviews with the patent agent, much letter writing, alterations and amendments, and perhaps the redrafting of the specifications and the drawings. The cost of all this will be very heavy, and the inventor may deem himself fortunate if it does not far exceed the original estimate for the patent. How does the new Act and rules encourage the inventor? It increases the cost of his patent, I said at least fourfold, and lucky will be the inventor who escapes so easily.

Why is the inventor taxed and tormented in this outrageous way. Is he a wild animal or a dangerous character that he should be exterminated? Mr. C. T. A. Hanssen, president of the Civil and Mechanical Engineers' Society, in opening their session expressed the opinion that "The whole structure of modern society was the direct outcome of patent law. Watt might have speculated on the properties of steam, but without the patent law he could never have induced a hard-headed man like Boulton to spend the large sum necessary to carry his speculations into practical effect." Undoubtedly it is to the inventor that we owe the creation of the many new industries employing many millions of capital and tens of thousands of our population. If England owes this to the inventor in the past it is but reasonable to expect that given proper encouragement they will carry their work yet further and create other new industries. In the industrial struggle between the principal manufacturing countries to obtain possession of the markets of the world that country will win which is in advance with new and improved manufactures, and if England is to maintain her position in this struggle the new patent law coming into force next year must be rescinded and either the old law retained or a more favourable one passed.

PRIVILEGES DESIRED BY THE INVENTOR.

What encouragement should the State give to the inventor? The inventors do not require offer of prizes or any other encouragement. They ask no privilege, no favour. But they demand as a right that the State shall protect them in the possession of their property. An inventor creates something, and until it is proved that his title is bad, it is his as against all the world. If the right of a person to hold land, which he did not create be admitted, it is hard to discover any good reasons why a man who has created property should not hold it in perpetuity. There appears however to be little hope of obtaining this justice.

Considering the length of time, often many years before many patents become commercial successes, it does not seem unreasonable to ask that the life of a patent should be increased to twenty years and in exceptional cases might be extended say another four or five years. It would perhaps be more convenient, to avoid complications in connection with the International Convention that the patent be dated from application. In theory it seems but just that a patent costing much in time and money should have a longer life than a simple patent. It would, however be very difficult to draw the line. Many simple patents are extremely useful and valuable. For example, a complicated machine costing much in time and money does not perfectly do the work required and it seems there is no alternative than to abandon the whole thing. But an inventor comes along and by some readjustment of wheels and perhaps adding some small part the machine works perfectly. Who shall say that this small invention was not valuable?

FOREIGN INVENTORS.

Foreign inventors should only receive the privileges secured under the International Convention. That is to say, if a British subject may obtain a patent in a foreign country for say, fourteen years, the foreign inventor should have the corresponding fourteen years' privilege in Great Britain. The question of foreign patentees working their patents in this country involving, as it does, the whole fiscal policy, seems too complicated to be dealt with in the space of a short paper.

THE WAYS OF THE OFFICIAL EXAMINER.

I have already shown that the new examination will increase the cost of the patent two or threefold, but even this is not its worst evil. Those who have applied for patents in any country where an official examination is made know only too well the erratic ways of the official examiner. Some will discover anticipation for everything. Some will discover [illegible] difference in principle and pass the invention. It is true that under the Act an inventor may claim his patent but with a notice impressed thereon that reference has been made to certain specifications. But this mark will be fatal to the unfortunate inventor, notwithstanding that he has examined hundreds of British and foreign specifications in search for anticipation. Notwithstanding that he has waded through dozens of patent case reports, notwithstanding that he has done all that mortal can do to avoid the labyrinth of pitfalls which beset the path of the inventor, the only reply of the manufacturer, the prospective buyer, to the prayers and arguments of the inventor will be, that he is not strong enough to contend with the might and majesty of the British Empire.

The value of an examination may be judged by the evidence given by Mr. Imray at the committee for reporting on the patent law.

The Master of Rolls: Will you read the [illegible]

As regards England there were in 1898 [illegible] applications for patents, of which 12,53[illegible] were completed. [illegible] patents were subject to litigation during the year and of these [illegible] were declared invalid. In France in 1898 there were [illegible] applications and patents of addition, while in the legal year [illegible] [illegible] patents were subject to litigation but only [illegible] of these had reference to validity, and of these only 12 were declared invalid. In Germany in 1898 there were [illegible] applications, only [illegible] were granted, [illegible] were subject to actions for annulment, [illegible] were wholly or partially annulled.

In the United States in 1898 there were [illegible] applications, of which [illegible] were granted, and [illegible] subject to litigation; of these [illegible] were declared wholly or partly invalid.

In summarising these data for [illegible] comparison [illegible] the following curious results are obtained:—

	Patents.	Void.	Per cent.
England	12,[illegible]	[illegible]	[illegible]
France	[illegible]	12	[illegible]
United States	[illegible]	[illegible]	[illegible]
Germany	[illegible]	[illegible]	[illegible]

[illegible] the value of the [illegible]

NEEDED REFORMS.

What should be done to encourage the British inventor? The inventor asks for nothing but justice. As a national asset a new industry is at least as valuable as a new novel. To create or even to make a serious attempt to create a new industry requires at least as much thought, labour, skill and capital as is required to create a new novel. Yet by the simple process of registration the author secures his rights for a long term of years. If the British inventor is to be encouraged, let him have the same privileges. Let the inventor file his specification and, if necessary, a model at the patent office at the cost of one pound; this will identify and secure the patent without examination and without guarantee of validity. There is but little danger of useless patents blocking a useful one. Manufacturers do not spend the large sums necessary to manufacture novelties and place a new article on the market before making thorough inquiry as to validity, and in case of any dispute the perusal of the correspondence between the inventor and the manufacturer would give a pretty clear idea of the value of the patent. In the case of a patent being proved of no value the patent office would have power to revoke the letters patent.

If, however, for revenue purposes the patent must be taxed, let the taxes take the form of royalty on the profits. Patents are either worth nothing, or they are worth a great deal, and it certainly seems more equitable that a man should be taxed on his profits than on his losses.

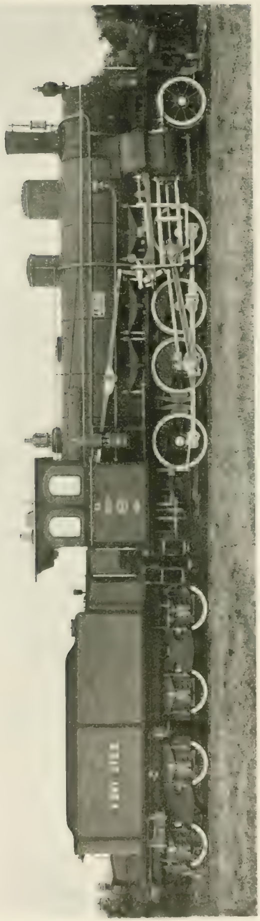
Another reform urgently needed is the simplification of law procedure. Only rich people can face the trial in the High courts, and the [illegible] Act might be amended that two [illegible] should [illegible] personally before some competent official of the patent office, who would adjudicate in the matter, his decision to be final without the intervention of lawyers.

Yours [illegible],

W. H. [illegible]

[illegible] contract for the central station of [illegible] [illegible] agreed to supply [illegible]

[illegible] by Messrs. Mather and [illegible], [illegible] Works, [illegible] Manchester [illegible] Messrs. [illegible]



EIGHT-COUPLED GOODS LOCOMOTIVE (E1-CLASS).
Built for the Bavarian State Railways by Messrs. Krauss and Co.

AN EIGHT-COUPLED GOODS LOCOMOTIVE FOR THE BAVARIAN STATE RAILWAYS.

THE engine illustrated herewith is the four-thousandth manufactured by Messrs. Krauss and Co., of Munich. The Bavarian State Railway possess at present eighty engines of the E1-class, sixty-six of which are of this special design. They are at work on the mountainous divisions between Aschaffenburg and Würzburg, and between Neuenmarkt and Hof.

The engines are now all of the simple expansion type, but originally two of them were compound engines, fitted with tandem cylinders of Sondermann's design. With this arrangement they performed good service for some years, but the cylinders were subsequently replaced by ordinary ones, as the gain derived from this method of compounding was not considered sufficient as to justify the complication and extra cost of repairs.

One of the tandem cylinders, including pistons, slide-valve, etc., has been cut through, following its middle plane and is shown in section at the Railway Museum at Nuremberg.

The engine is fitted with the Krauss-Helmholtz truck, which was introduced in 1888, and is to-day in use in some 1,500 engines. The details of this appliance are shown on the opposite page.

At present a further lot of E1-engines is under construction, but in these the boilers will be somewhat larger, its centre line being very high pitched, and the fire-box located entirely above the frames. The cylinders will be fitted with piston-valves.

(To be continued.)

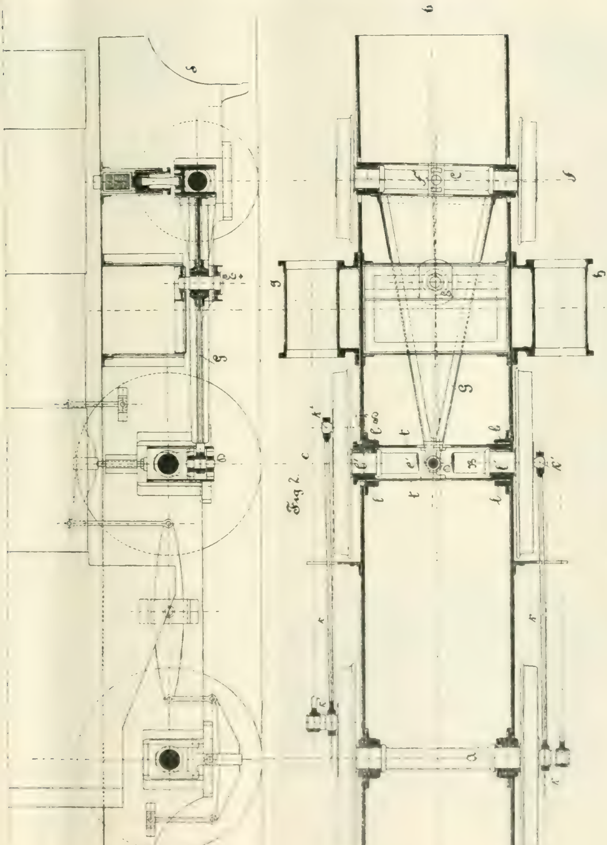


Fig 1

Fig 2.

DETAILS OF THE KRAUSS-HELMHOLTZ TRUCK.

IMPROVED SIGHT-FEED LUBRICATOR.

BY MESSRS. J. AND W. KIRKHAM.

We illustrate in figs. 1 and 2 an improved form of sight-feed lubricator made by Messrs. J. and W. Kirkham, Lark street, Bolton. The principal feature of novelty is in connection with the method of indicating the quantity of oil which is being discharged. For this purpose an air tube G (fig. 2) is provided, the admission of air being regulated by the valve I. When in action air bubbles rise from G, as shown in fig. 1, and oil equal in volume to these bubbles is discharged from the stem H. The rate at which the oil drops are delivered can be regulated by the valve I, the necessary amount being ascertained by experiment. Once the valve I is set to allow a given number of drops of oil per minute, it need never be altered, and all that is required to stop and start the lubricator is to give the valve E a slight turn. The lubricator is filled by unscrewing the plug A for about two revolutions, when oil poured into the dish B will run through the ports C into the lubricator. The plug A is then screwed down, the valve E given about half a turn, and locked in position with the nut F. Figs. 3 and 4 show a needle lubricator by the same makers which can be filled without moving the plug, the construction of the filling arrangement being the same as that already described. The advantage of avoiding the use of a plug is one that will appeal to many power users.

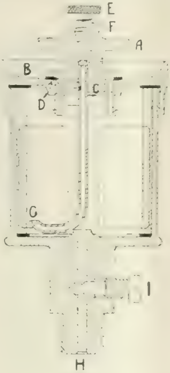


FIG. 1.

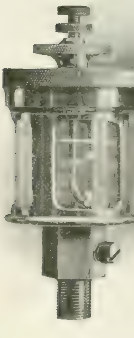


FIG. 2

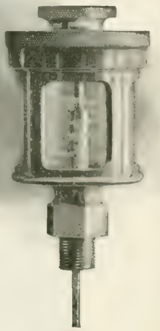


FIG. 4

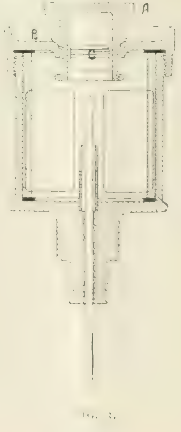
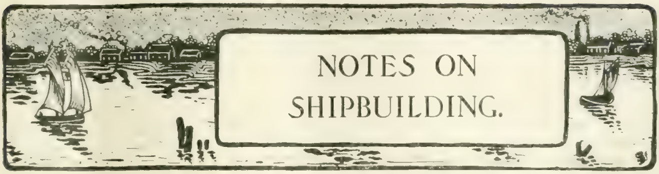


FIG. 3.



NOTES ON SHIPBUILDING.

The Industrial Position.

It cannot be said that any improvement has occurred in the shipbuilding situation since our last report. Some of the yards on Tyne and Clyde are well placed [illegible] enough but the majority of builders [illegible] quantity of work on hand and [illegible] A false impression as to the general condition of the industry has been suggested by the figures [illegible] total work on hand as reported by Lloyd's [illegible] how very large a proportion of that work is in very large ships, and how the restriction in the [illegible] under construction restricts [illegible] and the amount of employment. Some [illegible] contracts have been placed during the month, and it is reported that an agent of the Brazilian Government [illegible] to this country to negotiate contracts for three [illegible] battleships, three [illegible]-ton cruisers, [illegible] number of torpedo boats, submarines [illegible] Brazil [illegible] money it is to be hoped that [illegible] But of course there are only a few [illegible] number of men out of [illegible] Dundee yard the [illegible] Federation [illegible] about the rate of payment [illegible] Steel makers [illegible]

The World's Wastage.

[illegible] collision [illegible] Lloyd's [illegible] containing details as to the tonnage [illegible] This list deals with losses reported up to October 20th last, and it is based on the shipping statistics embodied in Lloyd's Register Book for [illegible]. The tonnage of steam and sailing vessels owned in the United Kingdom exceeds [illegible] tons, and with the Colonies it exceeds [illegible] tons. The tonnage owned by all the rest of the world is roughly [illegible] tons. Of the aggregate of [illegible] tons, the wastage during the three months was [illegible] tons. British ships, instead of being [illegible] of the whole, were little over one-fifth. The following are the figures applicable to the principal maritime nations:—

[illegible]	[illegible]	Percentage loss of tonnage owned.
United Kingdom (British) ..	[illegible]	[illegible]
Colonies (British)	[illegible]	[illegible]
American (Ocean) ..	[illegible]	[illegible]
Austro-Hungarian ..	[illegible]	[illegible]
Danish ..	[illegible]	[illegible]
Dutch	[illegible]	[illegible]
French	[illegible]	[illegible]
German	[illegible]	[illegible]
Italian	[illegible]	[illegible]
Norwegian	[illegible]	[illegible]
Russian	[illegible]	[illegible]
Spanish	[illegible]	[illegible]
Swedish	[illegible]	[illegible]

[illegible] Denmark, [illegible] American [illegible] per cent. In [illegible] Japanese vessels sunk during [illegible] and [illegible] Port Arthur [illegible] to the harbour, while others were destroyed either by mines or by the fire of Russian warships. This, of course, is not natural wastage.

Suez Canal Dues.

Great interest exists in shipping circles in the correspondence on Suez Canal tonnage dues between the Chamber of Shipping and the Board of Trade which has been going on since March last. The dispute began over the question whether dues should be charged on certain spaces of vessels which are partially closed, but which may occasionally be used for the stowage of cargo. The rule originally adopted on the Suez Canal was identical with that in all British ports, viz., that partially enclosed spaces should be called on for dues only when actually used, either on entrance or clearance. Two years ago the Canal policy was changed, and shipowners were notified that if utilised on any single occasion, exempted spaces would ever after be liable for rates, outwards as well as homewards, full or empty. The Canal Company maintained that the exemption of partially enclosed spaces had only been introduced under the arrangement of 1900 and discontinued by the subsequent arrangement of 1902. They also stated that some of the erections forming the enclosures were intended to reduce the rateable tonnage of the steamers. The Chamber of Shipping contended that the erections were mainly provided for the additional comfort and safety of the seamen, and that the Canal directors were wrong in their assumption that the exemptions had not been allowed from the very beginning of navigation on the Canal. The Board of Trade then took part in the dispute. At the request of the Suez Canal the Department had gone on measuring British steamers bound for the East on the new lines laid down for the Canal, and in doing so they had been breaking through the rules applied to British ports. They tried to get the Canal directors to modify the measurement regulations, supporting the contention of the shipowners that the erections are of value as protective spaces and are not primarily meant for the carriage of cargo. The Board of Trade proved partly successful, but while the Canal made allowances alongside the engine and boiler casings, they left untouched the principle advocated by the Chamber of Shipping that partially enclosed spaces should be liable to dues only when they are actually used for cargo purposes. The dispute took a new direction. The status of the London Committee of the Suez Canal Board was called in question and their representative character was challenged. That committee was formed in [illegible] to attend to such questions as might arise between the Company and their British customers," but when it was found that the fresh departure as to tonnage dues had been made at the instance of the London Committee, the Chamber of Shipping protested against its action in committing them without their knowledge to the treatment indicated of partially enclosed spaces, and also claimed a right to be consulted prior to any such important alteration in practice by the Suez Canal Company. That Company should not forget the Cape route. Meanwhile the Prince d'Arenberg, Chairman of the Company, has defended the London Committee, and traversed the statements of the Chamber of Shipping.

Belleville Boilers.

With regard to the water-tube boiler controversy, it is well to note the recent records of the Belleville type on board the first-class cruiser *Terrible* in her steaming to and from the Far East. These results indicate that the Boiler Committee, in its later judgment, was more correct than in its earlier condemnation of this type. Less coal was needed this year for the double run to Wei-hai-wei and back than in the single voyage home in 1902. The ship was longer out of the dry dock this year before starting on her long voyage and was more deeply laden to begin with, and nearly one foot deeper at the finish, so greater power was necessary to give the same speed. Two years ago the vessel steamed 11,045 miles in returning home, at an average speed of 11·8 knots, and required for making this distance 7,080 tons of coal. This year, in her round voyage, she steamed 21,741 sea miles at an average speed of 12·[illegible] knots, and the coal consumption totalled only [illegible] tons. On the voyage in 1902 the vessel was longer in port, but taking all the coal burned for every purpose, including harbour expenditure, the comparison is 11,163 tons for the single voyage in 1902 as compared with [illegible] tons for the double voyage this year. The coal burned per indicated horse-power per hour for the main engines was on the one run two years ago 2·[illegible] lb., and 1·7[illegible] lb. on the second voyage.

American Tonnage Tax.

In continuation of my former remarks on the American Tonnage Tax I may note that the Chief Commissioner of the United States Bureau of Navigation has intimated two important decisions of the Department. One concerns the Harrison liner [illegible] which on [illegible] at Pensacola from Great Britain via Tampico, Mexico, was assessed at the minimum rate of 3 cents per ton. Basing his action on a decision in an analogous case the Commissioner holds that the vessel should have been entered as from a foreign port via Tampico and the tonnage tax levied accordingly. In the analogous case the decision was that vessels coming to the United States on regular round trips, or *via* intermediate ports in the West Indies or Mexico ought not to be placed on a better footing as to tonnage dues than vessels coming direct. The other decision is more far reaching. It relates to tonnage taxes levied on the steamers [illegible] and [illegible] at Baltimore, where the practice has been to report for additional tonnage tax the gross measurement of spaces found to be taxable. "The regulations seem to contemplate," the Chief Commissioner informs the Collector of Customs, "the measurement of the entire capacity of a space under the shelter deck, constituting an upper-between deck, and the addition of the propelling power space contained in such between-deck space to the propelling power space of the vessel. A computation based on the total propelling and the entire gross tonnage is then to be made, as in other cases. In admeasuring space in a superstructure such as a bridge the capacity of the propelling power or light and air space exempt under Article [illegible], Regulations of 18[illegible], should be deducted, and the net tonnage of the space should be added to the gross tonnage of the vessel before the percentage of the entire propelling power space is computed. Should doubt exist as to the percentage of the entire propelling-power space, the admeasurement of the space occupied by the boiler, machinery and shaft alley only, and not of the entire vessel would be necessary. [illegible] the capacity of measurable space [illegible] with Article [illegible] of the Regulations of [illegible] is [illegible] approved."

New Dredger for the N.E.R. Company.

A [illegible] new dredger for the North Eastern Railway Company has been launched from the works of Messrs. [illegible] and Co., Ltd., Renfrew. It is [illegible] self-propelling, centre-ladder [illegible] [illegible] [illegible] width moulded, 4[illegible] [illegible]. The dredger is capable of [illegible] 45 ft. [illegible]

The gearing in the engine room has been designed for three speeds of buckets, viz., 1[illegible], 14 and 1[illegible] buckets per minute, and a special feature of the gearing is that either engine can drive the buckets at any of the three speeds, which has entailed a considerable amount of labour in devising a suitable arrangement, but the difficulties have been successfully overcome. The vessel is fitted with every contrivance for effective working. She has been named the *[illegible] Dale*, and is intended to work on the North Eastern Railway Company's new tidal harbour and dock extension works at Hartlepool.

Dock Dues on Warships

There has been for some time past a mild dispute between the Clyde Trust and the Admiralty concerning the basis on which dry-docking dues on warships should be charged. This has now been settled. Warships pay on gross tonnage only, a measurement fair enough in the case of merchant vessels, but not fair in the case of warships, the gross tonnage of which is very small, while they cost more time and trouble to dock, and monopolise the docks for considerable periods of time to the exclusion of better paying tonnage. The Admiralty are to continue paying on gross tonnage, but they will also pay for the pumping out of the dock for the preparation of the blocks prior to the entry of the vessel, the pumping out of the dock for the rearrangement of the blocks after the vessel leaves, and the payment of [illegible] for new cap blocks. The dues were paid in the first instance by the local shipbuilders, and in accordance with the new arrangement, the Clyde Trust are repaying to the Fairfield Company, to John Brown and Co., Ltd., and to the London and Glasgow Company, sums which they paid on the [illegible].

A [illegible] Mr. E. H. [illegible] [illegible] the recent number of the "National Service Journal," [illegible] the National Service League. [illegible]

[illegible]

PORTABLE STEAM ENGINES OF TO-DAY.

BY

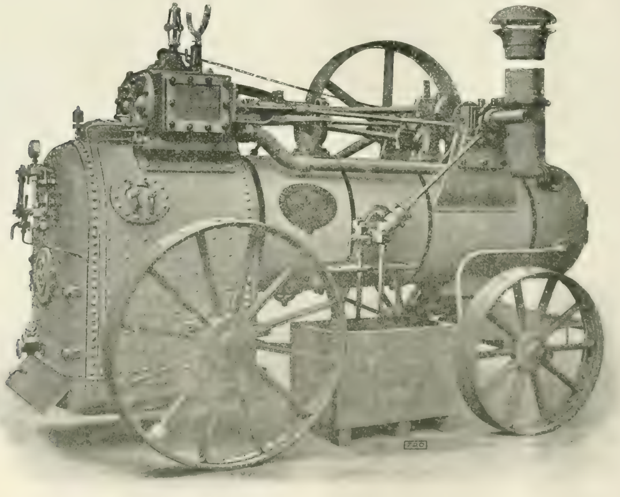
J. C. R. ADAMS.

This, the concluding article, is continued from No. 11. A theoretical and practical consideration of single-cylinder locomobiles, will be found in the July, August, and September issues of PAGE'S MAGAZINE. PAGE'S WEEKLY was commenced on October 14, 1904. ED.

VIII.

MESSRS. MARSHALL, SONS AND CO., LTD., of Gainsborough, build their compound portable engine in the 8, 10, and 12 h.p. sizes, in accordance with fig. 16, but in the 16 h.p. and 20 h.p. sizes the boilers are flush-topped. In the engine illustrated the Pickering throttling governor is employed, but, if desired, Messrs. Marshall supply automatic expansion gear, controlled by the Hartnell governor.

In all sizes the cylinder and crank-shaft plummer blocks are mounted on planed



MESSRS. MARSHALL, SONS AND CO.'S (LTD.) NEW TYPE COMPOUND PORTABLE ENGINE, 10 h.p. size, fitted with the Pickering governor and throttle valve.

brackets riveted to the boiler, and in the larger sizes these are united by steel tie rods. I am very glad to note that a substantial centre bearing is provided for the crank-shaft.

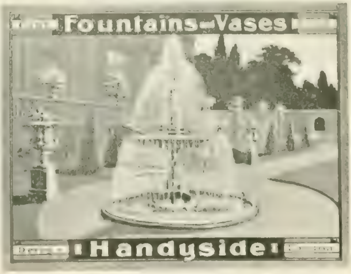
The cylinders, which are in one casting, are placed close together with the outside steam chests, and are supplied through a copper connection attached to a riveted seat on the boiler, the steam being taken up round the high-pressure cylinder, and in at the top, thus ensuring a supply of dry steam. To further promote this desirable end the drains from the cylinder jackets are carried to the smoke-box end of the boiler—a precaution praiseworthy in intention, but not, one would imagine, of any great service actually. Messrs. Marshall state that their engines will give off three times their nominal power when running at their standard speeds, the working pressure being 140 lb. I have already commented upon the excellence of this firm's workmanship, and can quite give credence to their assertion that their engines are capable of the utmost economy that can be obtained in an engine of the portable type.

CONCLUSION.

In the various examples of compound portable engines which have been illustrated it would be difficult, when all are so uniformly good, to absolutely award the palm to any one maker, though it would be an easy matter to suggest the design of an engine which should in itself embody all the best points of the collection. A triple-expansion locomobile has yet, I believe, to be produced, probably the first cost of such an engine would prevent its adoption to such an extent as to warrant the cost of production, but I may conclude with the suggestion that a condenser is an adjunct very easily applied even to a portable engine, and thus equipped, there are few steam engines whose performances in actual every-day working would excel the well-established record of the compound portable engine.

CATALOGUE COVER DESIGN.

SPECIMENS of design for this section are selected strictly in accordance with their intrinsic merit. Nothing specially good in production has been noted in the catalogues which have lately come to hand, and we turn therefore to one of the publications issued prior to the commencement of this series. Amongst these there is, perhaps, no more striking design than that of Messrs. Handyside's catalogue of fountains and vases. This has already been commended in Page's Weekly, and [illegible] now [illegible] [illegible] [illegible] [illegible] some of [illegible] than turn back to our [illegible] [illegible] [illegible] [illegible] and yellow. A striking [illegible] of light and shade is heightened by the [illegible] colour scheme. The artist shows a marble fountain, the amber waters of which are sharply outlined against a background of black and olive green, indicating terrace and parterres. The trees beyond are done in black, and the artist has cleverly [illegible] the [illegible] of the water from the fountain. We [illegible] [illegible] [illegible] the words "Fountains and Vases—Handyside" which are thus made to stand out [illegible] without [illegible] [illegible] [illegible].



"BOOKS ON BUSINESS."

"PORTS AND DOCKS."

This is one of the latest additions to Messrs. Methuen's excellent "Books on Business" series. It is only in a very limited sense a technical work; maintaining the tone and purpose of other works in the same series it is intended to ensnare the casual reader into acquiring a certain amount of useful knowledge without his becoming aware of the fact that he is being instructed rather than entertained. Hence, the rather trivial character from the engineering standpoint of the books of this series. The authors in the endeavour to steer between the Scylla of purely popular writing, and the Charybdis of sheer fact have had to reach conclusions at a bound. Not a little praise is, therefore, due to them for the amount of solid information they have managed to compress within their pages.

Mr. Douglas Owen in "Ports and Docks" is by turns historical, critical and prophetic. Touching the Thames, the general attitude of writers is to take the mud dredged out of the other rivers and throw it at the management of the Thames docks. The author does not go so far as this, but he voices the opinion that we have arrived at a most critical time in the history of the port, and without attempting to apportion the blame, he urges the need for reform.

The author of "The Automobile Industry" makes no pretence to teach the technically instructed, and he has been tempted to make but few incursions into the theory of the subject. The book is rather for the motor-purchasing public, and this, at least, can be said, that it is the result of personal experience and several years of careful observation. Types of motor are mentioned only so far as the type affects or varies working principles; and the matter has been brought fairly up-to-date. Part I. of the book is history, pure and simple. Part II. is descriptive of types of motors, and Part III. is devoted to construction. The book has a score or more of illustrations.

"Mining and Mining Investments" is another volume in this series. The appendix includes a reprint of the presidential address of Mr. Hennen Jennings to the Institution of Mining and Metallurgy, as well as papers by Mr. Walter McDermot on "Mining Reports and Mine Salting" and by Mr. G. D. Kendall on "Ore in Sight." The author accurately describes his work as a small book on a very large subject.

From] [illegible]

H.M.S. "SANSPAREIL" TESTING THE NEW BERMUDA FLOATING DOCK.

A COMPARISON OF VERTICAL AND HORIZONTAL TUBES IN WATER-TUBE BOILERS.

By W. R. Cummins.

THE object of this article is to raise a discussion on the relative merits of vertical and horizontal tubes in water-tube boilers. Water-tube boilers may be divided roughly into two classes, viz.:

(1) Those whose tubes run in a vertical or nearly vertical direction.

(2) Those whose tubes run in a horizontal or nearly horizontal direction.

Among those in the first division are:—Blechynden, Cahall, Cummins, Du Temple, Field, Fleming and Ferguson, Haystack, Hornsby (upright), Normand, Reed, Stirling, Thornycroft, Tinker, Weir, Yarrow.

Among those in the second division are: Babcock and Wilcox, Belleville, Climax, Durr, Hampston, Haythorn, Heine, Hornsby, Lagrafel d'Allest, Marshall, Niclausse, Solignac, Worthington.

At the outset it will be advisable to enumerate the conditions which have to be fulfilled to make a commercially successful boiler. The necessary conditions for success may be divided into four headings, viz:—

(1) Conditions affecting the fuel economy.

(2) Conditions affecting the weight and space economy.

(3) Conditions affecting the cost or capital economy.

(4) Conditions affecting the working or maintenance economy.

It is not contended that the conditions above are put down in the order of their importance. The relative importance of the above conditions varies, of course, for each particular case; for instance, condition (2) is not very vital for land boilers, but is of great importance for marine boilers.

Taking the first condition (1), the essentials for maximum economy are:—

(*a*) Perfect combustion.

(*b*) Perfect efficiency of the heating surface.

Perfect combustion is an unmixed blessing and does not interfere with any of the other

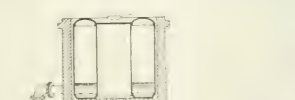


Fig. 1. Cahall Boiler.

economical conditions. On the other hand, to secure perfect efficiency of the heating surface would mean an almost unlimited amount of it, which would seriously interfere with weight and cost economy.

IMPORTANCE OF PERFECT COMBUSTION.

We thus see that it is of the greatest importance to secure combustion as near perfection as possible. To secure this end the first desideratum is a sufficiently large combustion chamber. Mere volume of combustion chamber is, however, not sufficient to get the best results. It is also necessary that it be put in the right place and be of the right shape. Although combustion chambers, or what serve as combustion chambers, are placed in various positions in different types of boilers, the right place is undoubtedly above the fire, so that the green gases coming off the fuel may thoroughly mix and burn before they are split up and distributed over the bulk of the heating surface. If the green gases coming off the fuel are at once brought into contact with heat-absorbing surfaces, they may become cooled down below the temperature of combination, entailing a serious loss of heat. This is why the shape of the combustion chamber is so important. It should be a high and open space right above the fire. A firebrick lining to the furnace and the combustion chamber is a great help to good combustion, as the heat accumulated in the firebricks from a clear fire is given up to the green gases when they are distilled off fresh fuel. For burning oil-fuel a brick-lined furnace or combustion chamber is an absolute necessity.

One of the chief sources of loss in burning fuel in a boiler is due to the excess air which has to be admitted to provide for complete combustion to CO_2 and H_2O. The whole of this excess air has to be heated up to the temperature of the rest of the gases and thus carries off a great deal of heat to the funnel. This source of loss is common to all boilers and may be largely reduced by skilled firing and proper proportioning of fire-bar spaces and air admission. It is very probable that with oil-fuel the excess of air over that actually required for perfect combustion is not so much as with coal-fuel; hence the furnace efficiency should be greater.

Stress has been laid on the importance of the shape of the combustion chamber. The object is to give the gases as long a time as possible in the combustion chamber to enable them to mix thoroughly with the least possible excess of air. If the gases are hurried through the combustion chamber, a large excess of air must be passed through to enable the carbonic oxide to pick up with certainty the additional oxygen to complete combustion to CO_2. It was pointed out above that the chamber should have its longest dimension in the direction in which the gases are travelling. In most cases this will mean that, given a certain volume, the longest dimension should be the height.

SHAPE OF COMBUSTION CHAMBER.

It might be argued that, giving a certain volume, the shape is quite immaterial, as the speed of the gases would be the same in each case; for instance, it might be said that a combustion chamber of 4 ft. by 2 ft. sectional area and 4 ft. high would be more effective than a chamber 4 ft. by 4 ft. by 2 ft. high, as the time occupied by the gases in passing through it would be the same in each case. Practically, however, the chamber 2 ft. high would be much less efficient on account of the high velocity of the gases passing through the fire-bars and the fuel. Naturally the area through the bars and through the fuel is restricted; consequently the gases are projected into the combustion chamber at a considerable speed, and if it had not a sufficient height the gases will only have a short stay in it.

It has been pointed out in a recent paper that the actual time taken by the gases to traverse the boiler is a matter of seconds only. The figures are at first sight rather startling and

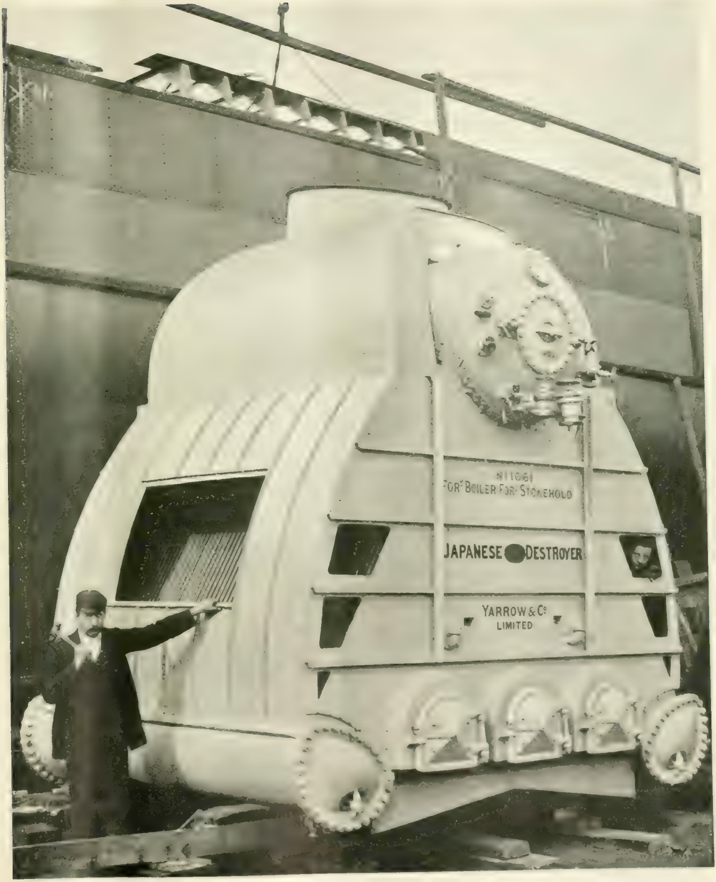


FIG. 2. THE YARROW BOILER.

help one to realise the necessity for the excess air admission found needful for complete combustion.

VERTICAL AND HORIZONTAL TYPES.

Having shown the need for a large and high combustion chamber, we can now consider which of the types—the vertical or the horizontal tube—is better adapted to secure this desideratum. The vertical water-tube type seems to be easily ahead of the horizontal tube type in this respect. The Yarrow (fig. 2), Thornycroft (fig. 3), and all the three-drum boilers have ample combustion space over the furnace. The Cahall, (fig. 1), Cummins, Hornsby and Stirling (upright) have all good combustion chambers. Coming to horizontal tube type, there seems to be only one with a good efficient combustion chamber, viz., the Lagrafel d'Allest All the rest have the lower row of tubes just above the fire-bars, and the green gases coming off the fuel must inevitably be cooled down below combination temperature. In addition to the serious loss of heat thus involved there is also the nuisance of black smoke at the funnel. The obvious remedy is to raise the tubes bodily further away from the fire-bars, but this does not lend itself very well to the design of these boilers, one serious disadvantage being the large areas at the sides of the boilers which have to be made as nearly heat-tight as possible.

In the Belleville boiler an endeavour has been made to overcome the defects of the combustion chamber by blowing air under pressure into it in fine jets. This, however, has been found to be insufficient, and the latest design has an auxiliary combustion chamber between the two nests of boiler and economiser tubes. Good results may, however, be obtained by suitable fuel and special methods of firing as was pointed by Engineer-Lieut. Baker. The fuel must be put on in handfuls at a time, the firing must be little and often. The combustion chambers of the Stirling and Hornsby (upright) boilers are excellent for two reasons, viz., they are of the right shape and have good capacity, also they are built of firebrick, and no trouble should ever be experienced in getting good combustion. In the Cahall boiler the furnace and combustion chamber are combined in one and are of firebrick. In the Cummins boiler the combustion chamber is a large free space above the furnace.

(To be continued

Read before the North-East Coast Institution of Engineers and Shipbuilders.

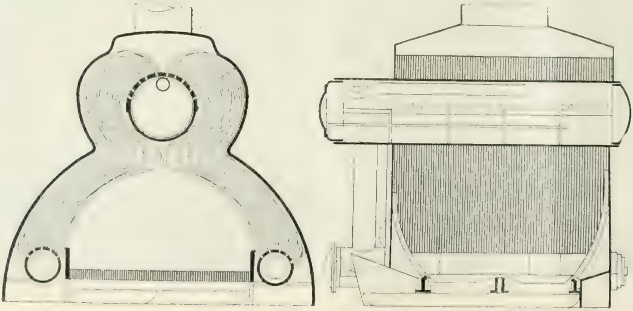


FIG. 3. THORNYCROFT BOILER.

THE WEEK AMONG THE TECHNICAL SOCIETIES.

THE INSTITUTION OF CIVIL ENGINEERS.

DISTRIBUTION OF ELECTRICAL ENERGY.

AT the ordinary meeting on Tuesday November 22nd, Sir Guilford L. Molesworth, K.C.I.E., President, in the chair, the paper read was "Distribution of Electrical Energy," by Mr. John F. C. Snell, M.Inst C.E. The following is an abstract of this communication.

The author describes the various systems by which electricity is at present distributed. The single-phase system is set aside as being inapplicable for general supply, as is also the direct-current high-tension system. The author is of opinion that the distributing systems which are likely to be adopted in the future are the direct-current, two or three-wire, for small districts; single-phase high-tension for railways; two-phase high-tension generation and low-tension distribution (for existing single-phase systems of general supply); three-phase high-tension generation and direct-current low-tension distribution (for existing direct-current systems in large districts, and for railways of short length); three-phase high-tension generation and low-tension three-phase or six-phase distribution (for entirely new and large districts).

Diagrams accompanying the paper demonstrate the economical radii of supply by direct current at 500 volts for different loads transmitted and by the high tension sub-station method, the result being that above the undermentioned distances the high tension method is more economical, viz.:

Kilowatts.	*Economical radius.*
250	1·0 mile
500 ..	1·25
[illegible]	1·50

With regard to the effect of storage at sub-stations, the author believes that storage will be more largely resorted to in the future. He next discusses the economical limit of pressure for high tension supply by underground cables and gives curves to show that for general purposes in Great Britain, 6,000 volts is approximately the economical pressure. The effect of the cost of insulation of extra high tension cables is also discussed. The paper also deals with the cost of overhead transmission of high tension currents, and reasons for fixing upon a pressure of 20,000 volts in this country are given.

As to the cost of supply, the ideal figure given by Colonel Crompton in 1894 is stated to have been surpassed, and a new ideal figure is given by the author based upon further experience gained in the past ten years.

CLASSES OF SUB-STATIONS.

The paper enumerates various classes of sub-stations covering static transformers for three-phase low tension distribution; static transformers with rotary converters for direct-current distribution; and synchronous or induction motor-generators for direct current distribution at the higher periodicity. Descriptions follow of the various sub-stations erected by the author, with curves of their outputs, and particulars of their efficiencies.

The various methods of distributing energy at low pressure are classified, and the relative merits of the conduit and the buried systems fully compared. A curve is given, showing the respective capital costs of the systems. The question of fusing the general network and the fixing of section-boxes is gone into fully; the author deciding against fuses, except in concentric networks, and strongly advocating the use of section-boxes for subdividing the network.

The author believes that a modification of the present third-rail system will remain with short-distance railways, and that improved methods in the application and control of single-phase currents will be adopted for long-distance railways.

TRAMWAYS AND LIGHT RAILWAYS ASSOCIATION.

THE L.C.C. TRAMWAYS.

The members of this Association recently carried out an interesting programme, when they paid a visit to the London County Council electric tramway works.

The Greenwich generating station was first visited, then the car shed and sub-station at New Cross, and finally the Clapham station, the members of the Association having special cars placed at their disposal to convey them from point to point. The Greenwich station is now approaching completion; the delivery of the main portion of the plant is expected early in

1905 and the first portion of the station will probably be at work by the end of that year.

The engine room will contain eight vertical-horizontal engines of 6,500 h.p. each, and each engine will have mounted on its shaft a three-phase generator of 3,750 kilowatts capacity. Four of these combined sets are being erected at present.

A NEW TYPE OF ENGINE.

The type of engine is a new one for this country, and it possesses several important features, as each engine is, in reality, two complete compound-engines, with the vertical h.p. cylinder and the horizontal l.p. cylinder on each side of the generator.

There are only two main bearings for the shaft, and the cranks are overhung. The vertical and horizontal connecting rods on each side, work on the same crank pin. Separate steam inlets and condensers are provided for each half-engine, so that in case of emergency, one half can be run without the other by removing the connecting rods. As the cranks are set 135 deg. apart, eight distinct steam impulses are obtained per revolution, resulting in a very even turning movement, so even, that an independent flywheel is not required. The drainage of the engines is perfectly natural, as the low-pressure cylinder is horizontal.

A re-heater receiver is employed between the high-pressure and low-pressure cylinders, and the receiver steam will be re-heated by means of live steam directly from the boilers.

The guaranteed steam consumption of these engines, with steam at 180 lb. pressure, super-heated to 500 deg. Fahr., and with a vacuum equivalent to 26 in. of mercury, is 11½ lb. per i.h.p. per hour.

Each half-engine will have its own surface condenser in the basement. The condensers will be of the surface type, each condenser having 4,500 square feet of tube area. A three throw Edwards' air pump, directly driven by a three-phase induction motor, will be used for draining each condenser and, by means of a small additional force pump, the condensed water will be taken into the hot-well tanks, which will be placed in the basement of the boiler house. Oil separators of the Baker type will be fixed between the l.p. cylinder and the condenser, which will take out the greater proportion of the oil in the steam before it reaches the condenser. Any oil which may be left will be removed by a Harris Anderson chemical filter before the water reaches the hot wells.

Each engine will carry on its shaft between the cylinders a three phase generator as mentioned above. The output of each machine will be 330 amperes per phase at 6,600 volts between phases and 25 cycles per second. The speed will be 94 revolutions per minute. The armature will be stationary, and the field revolving, the field coils being mounted on the periphery of the engine flywheel. The armature coils will be star-connected with the centre earthed. Each generator will have its own direct-current exciter, driven by ropes from a pulley on tde engine shaft.

The switch gear will be of the "remote control" type.

CAR-SHED AND SUB-STATION.

The car-shed at New Cross is now in process of construction, and, when finished, will have a capacity for 295 cars.

The sub-station, which may be regarded as a type, which operates the lines within the radius of about two miles, is equipped at present with three 300 kilowatts synchronous motor generators, and there is room for two others. The alternating-current side is operated at 6,600 volts, three-phase, and 25 cycles per second; and the direct-current side gives an output of 550 volts. The speed of each set is 300 r.p.m. The fields of the alternating-current motor are excited by a small direct-current exciter, carried on the same shaft.

For starting these machines, as well as for supplying current for lighting the sub-station, a 50 kilowatt self-starting induction motor generator is used; and, for this purpose, the direct-coupled exciter on each set acts as the starting motor for the time being. In addition to this method of starting, any machine can be run up from the direct-current side, once one of the sets is at work.

The switch gear is divided into three portions, viz., the high-tension gear, which has oil break switches, operated from the front of the board by levers; the gear for the low-tension side of the motor generators; and the low-tension distributor switch gear. This latter is of interest, as it has had to be specially designed for the operation of the conduit system. Each half mile of track is fed independently from this switchboard by both positive and negative feeders. Each feeder is provided with a reversing switch, by means of which its polarity can be reversed at any moment. The whole object of the switch gear is to keep all faults on one side of the system, so that the road may be worked even with a number of faults existing.

At a meeting held yesterday at the Society of Arts, the President, Mr. Alfred Baker, in the chair, Mr. Stephen Sellon, A.M.Inst.C.E., read a paper on "Running Powers." The author referred to the great advantages conferred by a system of running powers which avoided a break of service, and quoted instances of the loss of traffic which ensued, where the conversion of one portion of a through route to a new system of traction involved a break of journey.

MANCHESTER ASSOCIATION OF ENGINEERS.

ADJUSTMENTS AND ALLOYS OF ENGINE SHAFT BEARINGS.

A paper on this subject was read before this Association on Saturday last by Mr. Wm. Turner, of which the following is an abstract :—

The subject, says the author, is a very important one and does not receive the attention it deserves. It is not adequately dealt with in text-books and not even taught in technical schools. There is only one correct way, coupled with good workmanship, to adjust a bearing. After the shaft has been properly bedded and a good surface obtained the full length of the bearing, the top brass being always screwed tightly down on face or joint, a plug-gauge of a diameter equalling diameter of shaft plus fixed clearance must pass through bearing. (This for shafts under 5 in. diameter.) For shafts 5 in. diameter and over the same method is adopted, but the clearance is taken by leads.

The only good point about white metal for a bearing, and where it scores over phosphor bronze, is that it requires very little bedding. Being of a plastic nature it soon beds itself when the engine is started, and a clearance that mechanical skill ought to have provided is made by the shaft knocking down the high places. It should be noted, however, that when worn down white metal will be melted out without the engineer knowing the real cause of the trouble. The author thinks that white metal should not be used in the bed plate of an engine if good workmanship can be had. In a properly finished phosphor bronze bearing the surface contact (at the [illegible] parts) should be as good as mechanical skill can [illegible]. No skill can bed a shaft so well as its own running will do in time, but the mechanic's work on a bearing ought to approach as near as practicable to that perfection. Then no heating will follow, except from other causes which can be guarded against.

PHOSPHOR-BRONZE BEARINGS.

Phosphor bronze bearings have sometimes [illegible] because they have not been properly alloyed. [illegible] it may not be generally known that the [illegible] tin in a bearing renders it liable to [illegible] therefore very undesirable in an alloy for bearings, but it cannot be done without, as copper forms the basis of all bronze alloys, and is itself too soft; therefore it must be hardened by tin; but there is no reason for putting more of the latter in than is necessary for that purpose. No bearing for large and heavy shafts ought to contain more than 8 per cent. of tin, as this quantity will harden the alloy sufficiently to sustain the weight, provided there is a reasonable length of bearing surface. Small engines or light shafts need considerably less in proportion to size. If more tin is added a hot bearing is sure to result unless a large quantity of oil is used. Moreover the bearing is certain to develop cracks or hair-marks at the crown of brass and probably the brass will be found in two pieces in a very short time.

Again, a phosphor bronze bearing may be rendered utterly useless, notwithstanding the best workmanship in fitting it up, by the alloy being run too hot into the mould or by the use of inferior copper. Good phosphor bronze cannot be made from any copper; the copper and the tin must be of the best to get good results. Moulds for phosphor bronze should always be dried, otherwise the castings will be of no use for bearings.

The following table shows the result of a series of experiments on phosphor bronze bearings with the addition of a little lead used for railway axles :—

Kind of bearings	Composition of Alloy in 100 parts	[illegible]	[illegible]		Wear per [illegible] bearings	[illegible] per [illegible] for four bearings	Railways where the bearings are in use
			[illegible]	[illegible]	Grammes	Pence	
[illegible]	[illegible] copper [illegible]	[illegible]	[illegible]	[illegible]	[illegible]	[illegible]	[illegible] State [illegible]
[illegible]	[illegible]	[illegible]	[illegible]	[illegible]	[illegible]	[illegible]	[illegible]
[illegible]	[illegible]	[illegible]	[illegible]	[illegible]	[illegible]	[illegible]	[illegible]
[illegible]	[illegible]	[illegible]	[illegible]	[illegible]	[illegible]	[illegible]	[illegible] State Railway
[illegible]	[illegible]	[illegible]	[illegible]	[illegible]	[illegible]	[illegible]	[illegible]
[illegible]	[illegible] of Antimony	[illegible]	[illegible]	[illegible]	[illegible]	[illegible]	[illegible]
[illegible]		[illegible]	[illegible]	[illegible]	[illegible]	[illegible]	[illegible] Central [illegible]
[illegible]		[illegible]	[illegible]	[illegible]	[illegible]	[illegible]	[illegible]

UNNECESSARY FRICTION AND HEATING.

The familiar causes of [illegible] friction and [illegible] too soft [illegible] when [illegible] length of bearing [illegible] foreign matter. Yet if care is exercised during manufacture to ensure that all the proper conditions are fulfilled, there will be only two things to look for in case of a hot bearing—viz., lubrication and foreign matter.

On the first point, the author observes that two qualities are necessary in the lubrication: oil of sufficient viscosity and the correct molecular tension. To ensure these qualities in hydro-carbon oils, which are absolutely essential for safe running that manufactured by the system of fractional distillation should be used. Foreign matter will, of course, cause any bearing to become warm, and is calculated, like improper lubrication, to bring about similar results to bad adjustment.

An exhaustive discussion ensued, in the course of which many of the author's opinions were traversed, and ultimately, a cordial vote of thanks was recorded to Mr. Turner for his able practical paper.

LEEDS ASSOCIATION OF ENGINEERS

At a meeting of the Leeds Association of Engineers, held on November 24th, Mr. A. H. Hopkinson read a paper on "Steam Stop-valves and Gauges." Under modern conditions of steam, he said, the ordinary screw-down or wedge-type of valve was difficult to make fluid-tight, and was often dangerous. This had been borne out by the Board of Trade reports. Mr. Hopkinson pointed out the common defects, and described a valve in which he maintained these were practically eliminated. In addition to proper mechanism, he said, the materials should be suited to the different parts, the workmanship accurate, and each part separately tested both by water and steam. Valves had been made which worked satisfactorily under a pressure of 350 lb. per sq. in., and with 300 deg. of superheat. In the course of the discussion Mr. Robinson said that he had experienced some unfortunate accidents with steam valves. There was a continued readjustment necessary between increased pressures and more efficient valves. He expected to see pressure of 1000 lb. to the sq. in. The President (Mr. G. R. Goldsack) occupied the chair.

On Friday last, before the Manchester Students' Section of the Institution of Electrical Engineers, Mr H. C. Jenkins read a paper on "Electric Power in Machine Shops." A good discussion followed the reading, and was contributed to by Mr. A. E. Jepson, Hon. Sec., Mr. H. Lindley, M.I.E.E., and Messrs. Carey, Hanna, Jennison, and Mills.

JUNIOR INSTITUTION OF ENGINEERS.

THE DUDLEY PORT GAS DISTRIBUTION PLANT.

A large number of the members of the Junior Institution of Engineers, accompanied by the president, Mr. W. H. Lindley, and the chairman, Mr. Samuel Cutler, jun., availed themselves of the opportunity of visiting recently the Central Station of the South Staffordshire Mond-Gas (Power and Heating) Company, at Dudley Port. They were received by the managing director, Mr. Howell, the resident engineer, Mr. Lindop, and other gentlemen, Mr. H. A. Humphrey, the Company's consulting engineer, was prevented at the last moment from being present. The station, the first as yet erected, occupies a position which is practically the industrial centre of gravity of the district, comprising 120 square miles in South Staffordshire, over which the Company have powers. There are to be four units, each of eight producers, and the first unit, together with a complete set of spare towers, is now ready for working. Each producer is capable of gasifying one ton of fuel per hour throughout the day and night. The coal elevators, storage bunkers, producers, superheaters gas mains, mechanical washers and towers; the lead acid towers for sulphate of ammonia; and the cooling towers, were all examined with much interest. Steam is raised by means of climax vertical boilers arranged for burning small coal with forced draught and also for firing by gas. Fraser and Chalmer's compressor for putting the gas under pressure for distribution were seen in the machinery house, and two vertical Westinghouse gas engines driving various electric motors used in connection with the plant and for lighting. The pipes for conveying the gas to Wolverhampton Walsall and intermediate towns have been laid by Messrs. John Aird and Sons, and are mostly of the steel locking type made by Mephan Fergusson.

On Wednesday last, before the Students' Section of the Institution of Electrical Engineers, Mr. L. J. Pumphrey read a paper on "Motor-Controlling Switch Gear."

The members of the Civil and Mechanical Engineers' Society paid a visit on Friday last to the works in connection with the enlargement of Victoria Station The visit was made on the invitation of Mr. F. B. Brown, A.M.Inst.I.C.E., the resident engineer.

At the last meeting of the Nottingham Guild of Mechanical and Electrical Engineers, Mr. Wm. Chilton, of the Brush Electrical Engineering Company, delivered a lecture on the "Steam Turbine."

CONTRACTORS' NEWS.

We shall be pleased to insert under this column, free of charge, particulars of open contracts

CONTRACTS OPEN.

Last Day.

War Office.—Tenders wanted for dismantling, removing, and purchasing pumping machinery, etc., at Chattenden, Rochester ... ... Dec. 7

East Indian Railway.—Supply and delivery of spring steel. Mr. W. Young, Secretary ... ... Dec. 7

Welwyn.—No. 1 Contract: Conversion of existing outfall works, erection of pumping station and purification works ... Dec. 8

No. 2 Contract: Supply of oil gas engine and two double ram pumps, and other machinery .. Dec. 10

Dover.—Iron and steel, etc., for the Harbour Board. Mr. W. Mowll, Castle Street Dec. [illegible]

Birmingham.—Construction of flood works in connection with the River Rea at Saltley; also construction of Hennebique concrete bridges. Mr. John Price, City Surveyor, Birmingham ... ... Dec. 8

Nottingham.—Supply of miscellaneous stores and materials. Mr. S. J. Johnson, Town Clerk ... ... Dec. 8

Rangoon.—Supply of iron steam-buoy vessel. Messrs. Gillanders and Co., Sun Court, E.C. ... ... Dec. [illegible]

London, S.E.—Erection of an electric traveller to lift twelve tons over a span of [illegible]. Mr. B. E. Nightingale, builder and contractor, Albert Works, Albert Embankment, Lambeth, S.E. ... ... Dec. 10

Spain.—The Municipal authorities of [illegible] are inviting tenders until December [illegible] for the concession for the electric lighting of the town during a period of [illegible] years. Particulars may be obtained from El Secretario del Ayuntamiento de [illegible] ... Dec. [illegible]

Chippenham.—Sewage works and supply of pipes for new sewers. Mr. F. H. Phillips, Town Clerk. Dec. 1[illegible]

London.—Delivery and erection of [illegible] water tank for London County Council Tramways for use at Greenwich Station. Mr. G. L. Gomme, Clerk, London County Council ... ... Dec. 1[illegible]

South Indian Railway.—Supply of locomotive iron, etc. Mr. H. W. [illegible], Managing Director, 55, Gracechurch Street, E.C. Dec. [illegible]

Johannesburg.—Supply of two electric travelling cranes for the Municipal Council. Messrs. Mordey and Dawbarn, 82, Victoria Street, Westminster ... Dec. 2[illegible]

Edinburgh.—Supply, delivery, and erection of purifying plant house for Edinburgh and Leith Gas Commissioners. Mr. [illegible] M. G. Jack, 25, Waterloo Place, Edinburgh Dec. 1[illegible]

Last Day.

Australia.—Supply of the undermentioned telephone material. 19½ miles 26-pair lead-covered cable, dry core, to standard specification No. 7; 5,000 paper sleeves, 3 in. long by $\frac{3}{16}$ in. diameter; 350 yds. paper strips, [illegible] in. wide. General conditions, special conditions, specifications, schedule of items and tender forms may be obtained at the General Post Offices at Perth, Adelaide, Melbourne, Sydney, Brisbane, and Hobart Dec. 28

Ceylon.—To undertake and provide motor-car services for mails. Colonial Secretary, Secretariat, Colombo ... ... Feb. 1

Shanghai.—Construction of electric tramways for the Municipal Council. The Secretary, Municipal Council, Shanghai... Mar. 31

COMING CONTRACTS.

Aberdare.—The Council has resolved to construct six lines of tramways at a cost, including the provision of power station, cars and motors, car shed, and a refuse destructor, of £93,574 14s. 10d.

Dover.—The Corporation has decided to take over the powers of the River [illegible] Railways Syndicate, and to extend its electric tramways system to the suburb of River at a cost of £[illegible].

Luton.—The Town Council has resolved to apply to the Board of Trade for a provisional order authorising the construction of several lines of electric tramways in the town.

Bradford.—The Corporation is applying for tramway powers for [illegible].

Foots Cray.—The Urban District Council's electric lighting provisional order has been taken over by a company, and [illegible] be brought into operation.

Regent's Canal Railway.—A scheme is in course of preparation for an overhead electric railway from east to west over the Regent's Canal, London.

Central London Railway.—This Company is promoting a bill to extend its line. The intention of the company is to extend [illegible] eastwards from the Bank to Liverpool Street Station, returning by loop, and [illegible] Ludgate Hill, Fleet Street, Strand, [illegible] and Knightsbridge Road to Hammersmith. [illegible] the terminus the line will be continued to join the existing track at Shepherd's Bush.

Liverpool.—The Corporation [illegible] year take [illegible].

Fulham.—[illegible] erected at the [illegible] cost of [illegible].

Portsmouth.—[illegible] are to be fitted with the electric light. [illegible] will be required.

Bath.—Bath Electric Tramways, Ltd., propose to [illegible] new line.

CONTRACTS CLOSED.

London County Council.—The tenders of the following firms for the supply of stores, including electric fittings, cables, etc., have been accepted by London County Council: British Insulated and Helsby Cables, Ltd., Estler Bros., Falk, Stadelmann and Co., General Electric Company, Highton and Co., St. Helen's Cable Company, Siemens Brothers and Co., Craigpark Electric Cable Company.

Dundee.—The Tramways Committee have accepted the tender of Muir, Son and Patton for 4,000 tons of single nuts from a Lochgelly colliery at 8s. 2d. per ton.

Alloa.—Messrs. Mackay Brothers, who have now completed fitting out their new shipbuilding yard at Alloa, are about to start work on their first eontract. They have just received an order from the Shipping Agency, Ltd., London, for two steamers about 140 ft. long. The yard has been laid out on modern lines and is equipped with a complete and up-to-date installation of shipbuilding plant and machinery.

North Staffordshire Railway.—The directors of the North Staffordshire Railway Company have awarded Beyer, Peacock and Co., Ltd., a contract for the construction of two steam motor-carriages at a cost of £2,000.

Suez Canal Company.—Messrs. Lobnitz and Co., Renfrew, have commenced the construction of the large hopper dredger, which makes the seventy-eighth order for the same owners—the Suez Canal Company.

Tipton. Joseph Wright and Co., in addition to the large patent multiplex heater detartarizer, recently ordered by the Wath Main Colliery Company, Ltd., they have received orders from the British Admiralty, and from other sources.

Newcastle.—Ernest Scott and Mountain, Ltd., have recently secured several orders for their electric machinery, for use in collieries, from the Bedminster Coal Company; the Whitwick Colliery, Leicester; North Navigation Collieries; and the Wallsend and Hebburn Coal Company.

Thornaby-on-Tees.—Head, Wrightson and Co., Ltd., have just booked contracts for two steel pithead gears, 70 ft. high, for Penalltan Colliery, South Wales, also for coaling pontoon plant at Southampton, for the Powell Duffryn Steam Coal Company, Ltd.

Spain. Mather and Platt, Ltd., have secured an important contract for the plant required for the electric driving of two cotton mills in Spain. They will be among the largest and most complete installations of the kind.

Dublin.—The Dublin Dockyard Company have recently secured the contract to build a vessel of special design in connection with the main drainage improvements in that city.

Twickenham.—Destructor contract placed with Meldrum Brothers, Ltd., Timperley and London, for two 2-grate regenerative destructors, two Lancashire boilers, and one Babcock and Wilcox boiler.

Admiralty.—The Lords Commissioners of the Admiralty accepted the tender of Meldrum Brothers, Ltd., Timperley and London, for one 4-grate destructor with Lancashire boiler 30 ft. by 8 ft., for 200 lb. working pressure, in connection with the extensive electric light and power scheme at Chatham Dockyard. Consulting engineers, Messrs. Preece and Cardew.

Glasgow.—The Mirrlees Watson Company, Ltd., of Glasgow, have recently installed an extensive central condensing and cooling plant for the Scottish Co-operative Wholesale Society, at Shieldhall, Glasgow. The plant is designed to deal with 48,000 lb. of exhaust steam per hour.

Brussels.—The Corporation has accepted the tender of W. F. Jones and Co., for 2,500 cable connectors—with special pilot wire terminals.

APPOINTMENTS VACANT.

Ceara, North Brazil.—Engineer and Manager of Gas Company. Salary £400, and 5 per cent. on net profits.

India.—The Secretary of State for India has sanctioned the creation of the appointment of electrical adviser to the Government of India on Rs. 1,000—50—1,600 per mensem, whose headquarters will be at Calcutta. The present post of electrical engineer to the Government of Bengal will be abolished.

Glasgow.—A senior operator and a switchboard electrican are wanted for Glasgow Corporation Telephone Department. Applications to general manager (Mr. John Macfee), 65, Renfield Street, Glasgow ... Dec. 5

Admiralty.—A draughtsman is required for the electrical department, must have had training in mechanical engineering works, supplemented by experience of design of electrical machinery, switch gear, etc.—Applications to the superintendent electrical engineer (Mr. C. H. Wordingham) Dec. 5

APPOINTMENTS FILLED.

Wantage.—Mr W. Bardill has recently resigned his position as manager of Messrs. Heenan and Froude, Ltd., of Worcester, and has taken over the control of the works of the Wantage Engineering Company, Ltd., at Wantage.

Dartford.—Mr. J. D. Pember has been appointed as electrical engineer to the Urban District Council at a salary of £250 per annum.

Croydon.—Mr. C. Wyatt, A.I.E.E., formerly of the County of London Electric Supply Company is to take up the position of assistant engineer in the distribution department of the Borough of Croydon.

Askeaton.—Mr Joseph Bastick, of Limerick, will hold the position of non-residential consulting engineer to Messrs. Henson and Co., Askeaton Carbide Works, Askeaton, co. Limerick.

Bury.—Mr. Wm. Clough has been appointed manager of the borough tramways at a salary of £250

Marylebone.—The Electric Supply Committee have appointed Mr. F. G. Bacon, electric inspector to the Council, as house service inspector, at a salary of £100 per annum.

Chester.—Mr. Percy Heard, of the Westminster Electric Supply Company, has been appointed station superintendent at Chester Corporation electricity works.

London, Brighton, and South Coast Railway.—Mr. Marsh, of the Great Northern Railway, has been appointed chief mechanical engineer on the London, Brighton, and South Coast Railway in succession to the late Mr. Billinton.

Share List of Engineering, Electrical, Iron and Steel, and other Companies.

The following is a comprehensive list of Companies in the industries covered by "Page's Weekly," in which shares business is being currently transacted. Additions will be made from time to time as occasion requires. We desire it to be understood that while our Share List will generally be found correct, we do not hold ourselves responsible for any loss or inconvenience that may arise from possible inaccuracies.

STOCK EXCHANGE SETTLING DAYS.—**Settling days on the Stock Exchange are as follows :—**

Consols: January 5th. General Settlements: December 15th, 30th, January 13th. Bank Rate, April 21st, 3 per cent.

I.—ENGINEERING, IRON, AND STEEL COMPANIES.

Present Amount Subscribed	Shares	Last Dividend	Name	Paid up	Closing Prices
3,210,000	1	2 6	Armstrong (Sir W. G.), Whitworth and Co., Ltd.	1	3 — 3½
76,970	5	2 -	Do. 4% Cum. Pref.	5	5⅝ — 5⅞
1,500,000	100	4%	Do. 4% 1st Mort. Dbs. Rd.	100	102 — 104
£100,000	100	4½%	Aveling and Porter, Ltd., 4½%, Reg Mt. Debs. Red.	100	97 — 100
530,000	1	1 7½	Babcock and Wilcox, Ltd., Ord ..	1	3½ — 3⅝
100,000	1	7½d.	Do. „ 6% Cum. Pref.	1	1½ — 1⅝
20,000	5	3 -	Baker (Joseph) and Sons, Ltd. 6% Cum. Pref.	5	[illegible] — 5½
250,000	1	6½d.	Baldwins, Ltd., 5½% Cum. Pref. ..	1	1 — 1⅛
£250,000	Stk	4½	Do. 1st Mt. 4½% Deb. Stk. Red.	100	101 — 103
150,000	4½	2 -	Barrow Hæmatite Steel Co., Ld., O.	4½	1[illegible] — 1[illegible]
50,000	4½	6 -	Do. do. Cum 2nd. Pref	4½	3[illegible] — 4¼
33,334	5	2 6	Bayliss, Jones and Bayliss, Ltd., 5% Cum. Pref. Shares ..	5	4[illegible] — 5¼
£500,000	100	—	Beardmore (Wm.) & Co., Ltd., 4½% 1st Mt. Debs., Red., Scrip 50% pd		50 — [illegible]
50,000	10	6 -	Bell Brothers, Ltd., 6% Cum. Pref.	10	11[illegible] — 12¼
£366,600	Stk	4%	Do 4% Deb. Stock, Red	100	100 — 102
149,850	1	6d.	Bengal Iron and Steel Ord.	1	[illegible] — 1⅛
200,000	1	1 -	Beyer, Peacock and Co., Ltd., Ord.	1	[illegible]
300,000	1	6½d.	Do. 5½% Cum Pref.	1	[illegible]
£300,000	Stk	4¼	Do. 4¼% Red. Deb. Stock	100	96 — 99
1,629,760	1	6d.	Bolckow, Vaughan and Co., Ltd., O. Nos. 1-1,629,760	1	[illegible] — 1[illegible]
1,860,900	1	3d.	Do. Nos. 1,639,101-3,500,000	12	[illegible]
1,160,000	1	9d.	Brown (John) and Co., Lim., Ord., Nos. 1-1,160,000	15 -	1[illegible] — 1[illegible]
590,000	1	1 -	Do. Ord., Nos. 1,160,001-1,750,000	1	1[illegible] — 1[illegible]
74,000	10	5	Do. 5% Cum. Pref. ..	10	11 — 11[illegible]
154,500	5	2 6	Cammell, Laird & Co., Ltd., Ord	5	7 — [illegible]
232,500	5	2 6	Do. 5% Cum. Pref. ..	5	[illegible]
150,000	1	1 6	Clayton & Shuttleworth, Ltd., Ord.	1	[illegible]
70,000	5	2 6	Do. 5% Cum. Pref	5	5½ — [illegible]
£250,000	Stk	4	Do. 4% 1st Mort. Db. Stk. Red	100	100 — 102
100,000	10	[illegible]	Consett Iron Co., Ltd., Ord.	7½	30 — [illegible]
230,000	5	6	Cory (Wm.) & Son, Ltd., Ord.	5	7½ — 7¾
170,000	5	2 6	Do. 5% Cum. Pref.	5	[illegible]
£726,400	Stk	4	Do. 4% 1st Mort. Db. Stk. Red	100	104 — [illegible]
1,259,594	1	[illegible]	Dorman, Long & Co., Ltd.	1	[illegible]
£400,000	Stk	4	Do. 4% 1st Mort. Perp. Deb. Stk	100	[illegible]
£250,000	Stk		Do. 6% 2nd Mort. Deb Stk, Red Prov. Crts. 60% pd.		[illegible]
273,000	1	1	Dundee Coal Co., Ltd. (Natal)	1	[illegible]
200,000	[illegible]	[illegible]	Dunderland Iron Ore Co., Ltd., 6% Cum. Pref. and Participating	5	[illegible]
250,000	1	[illegible]	Dunlop James & Co., Ltd., Ord.	1	[illegible]
300,000	1	7 [illegible]	Do. 6% Cum. Pref.	1	[illegible]
4,721	13	[illegible]	Ebbw Vale Steel Iron & Coal Co., Ltd.	[illegible]	[illegible]
69,754	13	12	Do. do. do.	[illegible]	[illegible]
25,000	10	6	Fairfield Shipbuilding & Engng. Co. Ltd., 6% Cum. Pref.	10	[illegible]
£250,000	Stk	[illegible]	Do. 4½% Mort. Deb. Stk. Red.	[illegible]	[illegible]
126,000	3	[illegible]	Fraser & Chalmers, Ltd., Ord.	3	[illegible]
21,000	3	[illegible]	Do. 7½% Cum. Pref.	[illegible]	[illegible]
965,000	1	1	Guest, Keen & Nettlefolds, Ltd. Ord.	1	[illegible]
344,000	5	2 6	Do. 5% Cum. Pref.	5	[illegible]
£1,850,500	Stk	4	Do. 4% Irred. Mort. Deb. Stk.	[illegible]	[illegible]
13,100	[illegible]	2 6	Gwynnes, Ltd., 5% Cum. Pref.	[illegible]	[illegible]
250,000	1	1	Hadfield's Steel Foundry Co., Ltd., Ord.	1	[illegible]
20,000	10	[illegible]	Do. [illegible] Cum. Pref. ..	[illegible]	[illegible]
30,000	5	[illegible]	Hall J. & E., Ltd. 6% Cum. Pref.	[illegible]	[illegible]
408,505	1	1 [illegible]	Harvey United Steel Co., Ltd.	1	[illegible]
28,001	[illegible]	5	Head, Wrightson & Co., Ltd.	[illegible]	[illegible]
85,000	1	7 [illegible]	[illegible] & Co. (1896) Ltd., Ord.	1	[illegible]
18,000	5	[illegible]	Do. 6% Cum. Pref.	[illegible]	[illegible]
30,000	10	[illegible]	Hornsby Richard & Sons, Ltd., Ord.	[illegible]	[illegible]
750,000	1	1 [illegible]	Howard & Bullough, Ltd., Ord.	1	[illegible]
25,000	10	6	Do. 6% Pref. (Non Cum.)	[illegible]	[illegible]
£250,000	Stk	4	Do. 4% Deb. Stk., Red. [illegible]	[illegible]	[illegible]
300,000	1	[illegible]	Lambert Bros., Ltd., Ord. ..	1	[illegible]
50,000	5	[illegible]	Do. 5½% Cum. Pref.	[illegible]	[illegible] — 4½
40,000	3	2 [illegible]	Leeds Forge Co., 7% Cum. Pref.	[illegible]	[illegible] — 4¼
$6,810,000	$1,000	[illegible]	Lehigh Valley Coal Co., 1st Mort. 5% Guar. Gold Coup. Bds.		[illegible]

ENGINEERING, IRON, AND STEEL COMPANIES.—*Contd.*

Present Amount Subscribed	Shares	Last Dividend	Name	Paid up	Closing Prices
200,000	1	7½d.	Lysaght (John), Ltd., 6% Cum. Pf.	1	1[illegible] — 1[illegible]
£300,000	Stk	4½	Do. 4½% 1st Mt. Deb. Stk., Red.	100	108 — 110
40,000	10	5	Mather & Platt, Ltd., 5% Cum. Pref.	10	10[illegible] — 11¼
210,000	1	6d.	Measures Bros., Ltd., Ord.	1	[illegible] — 1¼
75,000	1	6d.	Do. 5½% Cum. Pref. ..	1	[illegible]
£75,000	Stk	4½	Do. 4½% 1st Mt. Db. Stk., Red.	100	96 — 99
5,000	62½	47 6	Nantyglo and Blaina Iron Works, Ltd., 8% Cum. Pref.	62½	71 — 73
11,548	20	8 -	New Sharlston Collieries Co., Ld. P.	20	14 — 15
73,000	10	5 -	N. Brit. Loco. Co., Ltd., 5% Cm Pf.	10	11¾ — 12
80,000	5		North Eastern Steel Co., Ltd., Ord.	5	
£250,000	Stk	4½	Do. 4½% 1st Mt. Db. Stk., Red.	100	92 — 95
120,000	5	5 -	North's Navig. Collieries ('89), Ld., O	5	[illegible] — 6½
10,000	5	5 -	Do. 10% Cum. Pref. ..	5	9½ — 10
122,000	5	2	Pearson & Knowles Coal and Iron Co., Ltd., Ord., "B"	5	3½ — 3⅝
50,000	5	3 -	Do. 6% Cum. Pref. "A"	5	5[illegible] — 6¼
70,000	10	6 -	Pease & Partners, Ltd., Ord.	10	8[illegible] — 8¼
£400,000	Stk	4	Do. 4% Perp. Deb. Stock	100	97 — 100
20,000	5	3 -	Peebles Bros. & Co., Ld., 6% Cm.P.	5	4[illegible] — 5
230,000	1		Projectile Co. (1902), Ltd., Ord.	1	[illegible]
126,938	5	2 -	Rhymney Iron Co., Ltd. ..	5	1½ — 1[illegible]
73,162	5	2 -	Do. New ..	5	1⅝ — 1[illegible]
£330,000		5	Do. [illegible] Mort. Deb., Red	100	101 — 104
350,000	1	7½d.	Richardsons, Westgarth & Co., Ltd., 6% Cum. Pf.	1	[illegible]
£350,000	Stk	4½	Do. 4½% Perp. Deb. Stock	100	94 — 97
90,000	5	2 [illegible]	Rickett, Cockerell & Co., Ld. 4½% C.P.	[illegible]	4[illegible] — 4¾
150,000	1	3½d.	Russian Collieries, Ld., 7% Cum. Pf.	1	[illegible]
35,000	10	12	Ruston, Proctor & Co., Ltd.	10	9½ — 9[illegible]
27,000	1	6d.	Scott (Walter), Ltd., Ord. ..	1	[illegible] — 1
300,000	1	7½d.	Do. 6% Cum. Pref.	1	1 — 1⅛
£330,000	Stk	4	Do. 4% Perp. Deb. Stk.	100	95 — 97
£115,300	100	7	Shelton Iron, Steel and Coal Co., Ltd. 1st Charge [illegible] Debs. Red	100	91 — 94
£97,000	100	6	Do. [illegible] 2nd Mort. Debs. Red	100	90 — 95
7,500	10	[illegible]	[illegible] Collieries, Ltd., 6% Cm. Pref.	10	9[illegible] — 10¼
93,800	100	5	Do. [illegible] Reg. Red	100	100 — 102
250,000	1	1	South Durham Steel & Iron, Ltd. O.	1	[illegible]
300,000	1	7 [illegible]	Do. [illegible] Cum. Pref.	1	[illegible]
£100,000	Stk	4½	Do. 4½% Per. Deb. Stock	100	74 — 76
[illegible]	10	[illegible]	South Hetton Coal Co., Ltd., Ord.	10	17 — 19
[illegible]	10	[illegible]	Do. 5% Non Cum Pref	10	9[illegible] — 10¼
[illegible]	10		Stephenson, Robert & Co., Ltd., Ord.	10	[illegible]
[illegible]	10	5 [illegible]	Do. [illegible] Cum. Pref.	10	[illegible]
£2[illegible]	Stk	4	Do. 4% Perp. Deb. Stock	100	75 — 77
[illegible]	10	[illegible]	Stewarts & Lloyds, Ltd., Ord.	10	1[illegible] — 17¼
55,000	10	6	Do. 6% Cum. Pref.	10	14 — 14½
634,732	1	[illegible]	Swan Hunter & Wigham Richardson, Ltd. Ord.	1	[illegible] — 1
[illegible]	1	6d.	Do. [illegible] Cum. Pref.	1	[illegible] — 1[illegible]
£[illegible]	Stk	4½	Do. 4½% 1st Mort. Deb. Stk. Red	100	98 — 101
[illegible]	1	[illegible]	Thames Iron Works, Shipbuilding & Engineering Co., Ltd., [illegible] Cum. Pf.	1	[illegible]
£[illegible]	100	4	Do. 4% [illegible] Mort. Deb.	100	6[illegible] — 70
£150,000	1	7d.	[illegible] Ltd. [illegible] Pref.	1	[illegible] — 1[illegible]
[illegible]	10		[illegible] & Sons, Ltd. [illegible] Pf.	10	[illegible] — 10[illegible]
£[illegible]	[illegible]	[illegible]	[illegible] Debs.	100	[illegible] — 70
[illegible]	[illegible]	[illegible]	[illegible]	[illegible]	[illegible]
[illegible]	[illegible]	[illegible]	Do. [illegible]	[illegible]	96¼ — 97
[illegible]	[illegible]		Do. [illegible]	[illegible]	[illegible] — 97
[illegible]	1		Vickers, Sons & Maxim, Ltd. Ord.	1	[illegible] — 2
[illegible]	1	[illegible]	Do. 5% Non Cum. Pref.	1	[illegible] — 1[illegible]
£[illegible]	[illegible]		Do. [illegible] Cum. Pref. Stock	100	[illegible] — 11[illegible]
£[illegible]	[illegible]	[illegible]	Do. [illegible] Mort. Debs. Red	100	[illegible] — 10[illegible]
£[illegible]	[illegible]	[illegible]	Do. [illegible] Mort. Debs. Red	100	[illegible] — 10[illegible]
[illegible]			[illegible] Ord	1	[illegible]
[illegible]		[illegible]	[illegible]	1	[illegible]
£[illegible]	[illegible]	[illegible]	[illegible] Perp. [illegible]	100	7[illegible] — [illegible]
[illegible]			W[illegible]	[illegible]	1 — [illegible]
[illegible]			[illegible]	[illegible]	[illegible]
[illegible]	[illegible]	[illegible]	D[illegible] Mort. Deb. [illegible] Red.	100	7[illegible] — 80
£[illegible]	[illegible]	[illegible]	[illegible] Iron [illegible] Co., Ltd. [illegible] Mort. Deb. Stk. Red	100	80 — [illegible]

Stock and [illegible]

II.—ELECTRICAL MANUFACTURING COMPANIES.

Present Amount Subscribed	Shares	Last Dividend	Name	Paid up	Closing Prices
70,000	1	6d.	Alliance Elec. Co., Ltd. 5%, Cum. Pf.	1	[illegible]
125,000	1	7½d.	Aron Elec. Meter Ltd., 6% Cum Pf.	1	[illegible]
120,000	1	9d.	Bell's Asbestos Co., Ltd.	1	½ - [illegible]
100,000	5	4/-	British Insulated & Helsby Cables Ltd., Ord.	5	5¼ 6
100,000	5	3/-	Do. 6% Cum. Pref.	5	5¾ 6
£500,000	Stk	1½	Do. 4½% 1st Mort. Deb. Stk. Rd.	100	102 105
£200,000	Stk	1½%	British Thomson-Houston Co., Ltd. 4½% 1st Mort. Deb. Stk. Red.	100	100 102
400,000	5	3/-	British Westinghouse Electric and Manufac. Co., Ltd., 6% Pref.	5	2⅝ 2⅞
£616,353	Stk	4	Do. 4% Mort. Deb. Stk Red.	100	88 90
35,000	5	5	Callender's Cable & Constn. Ltd. Ord.	5	9 10
40,000	5	2/6	Do. 5% Cum. Pref.	5	5½ 5¾
£400,000	Stk	1½	Do. 4½% 1st Mort. Deb Stk. Red.	100	104 106
52,000	5	10/-	Dick, Kerr & Co., Ltd., Ord.	5	7¼ 7¾
61,000	5	3/-	Do. 6% Cum Pref.	5	5¼ 5½
£500,000	Stk	1½%	Do. 4½% Deb. Stock, Red.	100	104 106
233,334	1	6d.	Doulton & Co., Ltd., 5% Cum. Pref.	1	1¼ 1½
£233,334	Stk	4	Do. 1st Mort. 4% Irre. Deb. Stk.	100	106 109
99,261	5	1/6	Edison and Swan United Electric Light, Ltd., "A" Shares Nos. 1-99,261	3	[illegible]
17,139	5	2/6	Do. "A" Shares Nos. 01-017 139	5	1 1¼
£344,023	Stk	4	Do. 4% Deb. Stock Red.	100	78 83
£100,000	Stk	5	Do. 5% Second Deb. Stk. Red.	100	79 84
112,100	2	1/7	Electric Construction Co. Ltd.	2	1⅛ 1¼
31,390	2	2/9	Do. 7% Cumulative Pref.	2	2 2¼
£200,000	Stk	4	Do. 4% Perp. 1st Mt. Deb. Stk.	100	98 100
10,248	10	7/6	Evered and Co., Ltd.	10	13 15
£100,000	Stk	5	Ferranti, Ltd., 5% 1st Mort. Deb. Stock, Red.	100	90 95
25,000	10	5/-	Gen. Elect. Co. (1900), Ltd., 5% Cum. Pref	10	9½ 10
£200,000	Stk	4	Do. 4% 1st. Mt. Deb. Stk., Red.	100	91 96
35,000	5	5/-	Henley's (W. T.) Telegraph Works Co., Ltd., Ord.	5	10¼ 11¼
37,000	5	2/3	Do. 4½% Cum. Pref.	5	5 5½
£50,000	Stk	4½	Do. 4½% Mt. Deb. Stk. Red.	100	109 111
40,000	10	5	India Rubber, Gutta Percha & Telegraph Works Co., Ltd.,	10	19½ 20½
£300,000	100	4%	Do. 1st Mort. Deb. Red.	100	99 102
37,350	12	12	Telegraph Construction and Maintenance Co., Ltd.	12	38 40
[illegible]	100	4	Do. 4% Deb. Bonds	100	103 105

III.—ELECTRIC TRACTION.

Present Amount Subscribed	Shares	Last Dividend	Name	Paid up	Closing Prices
120,310	5	3	Anglo Argentine Trams Co., Ld., Or.	5	6¾ 7¼
200,117	5	2/6	Do 5% Cum Pf.	5	4¾ 5¼
£200,000	Stk	6	Do. Permanent 6% Debenture Stock, 1888	100	113 116
£200,000	Stk	5	Auckland Electric Trams Co., Ltd., 5% 1st Mort. Deb. Stock, Red.	100	106 107
20,000	10	6/-	Barcelona Trams Co., Ltd., Ord.	10	9 10
10,000	10	5	Do. 5% Cum Pf Share	10	9 10
£40,200	100	5	Do 5% Debs., Red.	100	98 101
£191,325	Stk	4½	Do 4½ Red. Deb. Stk	100	91 96
75,016	1		Bath Elec. Trams Ld., Pt. Or.	1	[illegible]
29,504	1		Do. 5% Cum. Pf.	1	1½
75,000	5		Brisbane Electric Tram Investment Co., Ltd., Ord.	5	1¾ 2¼
75,000	5	2/6	Do. 5% Cum Pf.	5	3¼ 4¼
£125,000	Stk	4½	Do 4½ 1st Deb Stk., Red	100	96 100
£210,000	Stk	4	Brit. Columbia Elec. Rly. Co., Ltd., Def. Ord. Stk	100	100 103
£200,000	Stk		Do Pref. Ord. Stock	100	102 105
7,500	10		Do 5% Cum Perp Pf	10	10¼ 10¾
£242,800	10	4½	Do 4½ 1st Mort. Debs.	10	102 104
£220,000	100	4½	Do 4½ Vancouver Power Db.	100	97 100
133,001	10	4	Brit. Electric Traction, Ltd., Ord.	10	9¼ 10¼
156,127	10	6	Do. 6% Cum. Pref.	10	10¾ 11½
£1,600,000	Stk	5	Do. 5% Perp. Deb. Stk.	100	117 119
£270,000	Stk	4½	Do. 4½ 2nd Deb. Stk., Red.	100	95 97
100,000	5	1/1	Buenos Ayres & Belgrano Electric Trams, Ltd., Ord.	5	3¾ 4
40,500	5		Do "A" 6% Cum Pref.	5	5¼ 5¾
37,000	5		Do "B" do	5	5½ 5¾
£300,000	Stk	5	Do. 5% Deb. Stk., Red	100	105 108
£100,000	Stk	5	Do. 5% 2nd Deb Stk., Red.	100	102 105
£200,000	Stk	5	Buenos Ayres Elec Trams Co. (1901) Ltd., 5% Deb. Stk., Red	100	96 99
£220,000	100	6	Buenos Ayres Gd. Nat., Ltd., 6% 1st Deb. Bds	100	97 100
£150,000	100	5½	Do. 5½ Pref. Debs	100	101 104

ELECTRIC TRACTION.—*Contd.*

Present Amount Subscribed	Shares	Last Dividend	Name	Paid up	Closing Prices
102,268	5	3/-	Calcutta Tramways Co., Ltd.	5	7¾ 8
£350,000	Stk	1½%	Do. 4½%, 1st Deb. Stk., Red.	100	106 108
480,000	1	1/-	Cape Electric Tramways, Ltd.	1	1½ 1⅝
40,000	5	2/6	City of Birmingham Trams Co., Ltd. 5%, Cum. Pref.	5	4⅞ 5⅛
£300,000	100	4%	Do. 4%, 1st Mort. Debs.	100	98 101
155,000	5	4/-	City of Buenos Ayres Trams. Co., Ld.	5	10¼ 10½
£116,000	Stk	6	Do. Per. 6% Deb. Stk.	100	140 145
£120,000	Stk	5%	Colombo Elec. Tram. & Light. Co., Ltd., 5%, 1st Mort. Deb Stk. Red.	100	101 104
60,000	10	6/-	Dublin United Trams. Co. (1896), Ltd., Ord.	10	13 14
59,987	10	6/-	Do. 6% Pref.	10	15 16
30,000	5	2/6	Isle of Thanet Elec. Trams. and Light. Co., Ltd., 5% Cum. Pref.	5	3¼ - 4¼
£150,000	Stk	1%,	Do. 4% Deb Stock	100	90 93
125,000	10	5/-	London United Trams (1901), Ltd., 5% Cum. Pref.	10	10⅝ 10⅞
£1,031,000	Stk	1%	Do. 4% 1st Mort. Deb. Stk. Red.	100	104 106
£50,000	Stk	—	Madras Electric Trams (1904), Ltd., 5% Deb Stock, Red.	100	103 105
314,016	1	—	Metropolitan Elec. Trams, Ltd., Def.	1	¼ ½
500,000	1	6d.	Do. 5% Cum. Pref.	1	¾ 1
£350,000	Stk	13/7	Do. 4½ Deb Stock, Red.	100	103 105
50,000	5	6/-	New General Traction Co., Ltd., 6% Cum. Pref.	5	1 1¼
110,923	8	2/9	North Metropolitan Tramways Co.	8	3¼ 3¾
£150,000	100	3½%	Do. 3½% Mort. Debs.	100	87 92
£196,200	Stk	5%	Perth Electric Trams, Ltd. (W.A.) 5% 1st Mort. Deb Stock, Red.	100	103 106
24,500	10	10/-	Potteries Elec. Traction Co., Ld., Or.	10	8 9
24,500	10	5/-	Do. 5% Cum. Pref.	10	8½ 9½
£220,000	Stk	4½	Do. 4½% Deb. Stk., Red.	100	99 102

IV.—ELECTRIC LIGHTING AND POWER.

Present Amount Subscribed	Shares	Last Dividend	Name	Paid up	Closing Prices
7,500	10	10/-	Bournemouth & Poole Elec. Sup. Co., Ltd., Ord.	10	12 – 13
7,500	10	4/6	Do. 4½% Cum Pref.	10	9½ – 10
7,500	10	6/-	Do. 6% Cum. Second Pf.	10	11 – 12
£70,000	Stk	4½	Do. 4½% Deb. Stock Red	100	104 –106
14,000	5	2/-	Bromley (Kent) Elec. Lt. & Pr. Co. Ld	5	5¼ – 5¾
£50,000	Stk	4½	Do. do. 4½ 1st Deb. Stk. Red.	100	101 104
27,507	5	1/6	Brompton & Kensington Elec. Supply Co., Ltd. Ord.	5	10½ - 11
12,493	5	3/6	Do. 7% Cum. Pref. Shares	5	10¼ – 10¾
105,731	2	2/-	Brush Elec. Enging. Co., Ltd., Ord.	2	[illegible] ⅝
150,000	2	2/4	Do. 6% Pref.	2	1¼ - 1½
£125,000	Stk	4½%	Do. 4½ Perp 1st Deb. Stk.	100	93 - 96
£125,000	Stk	4½	Do. 4½ Perp. 2nd Deb. Stk.	100	69 – 73
60,000	5	3	Calcutta Elec. Sup. Cor. Ltd., Ord.	5	7¼ – 8
£288,782	Stk	4	Central Elec. Sup. Co., Ltd., 4% Gua. Deb. Stk.	100	106 109
70,000	5	4/-	Charing Cross & Strand Elec. Sup. Corp., Ltd., Ord	5	8½ 9
10,000	5		Do. do. Ord.	5	8 – 8½
80,000	5	2/3	Do. do. 4½% Cum. Pref.	5	5¼ - 5¾
£350,000	Stk	4	Do. do. 4% Deb. Stk. Red.	100	103 –105
40,000	5	2/3	Do. do. "City Undertaking" 4½ Cum. Pref.	5	4¼ - 5
40,000	5	2/3	Do. do. do. (1903)	5	4¼ 5
11,136	5	2/3	Chelsea Elec. Sply. Co., Ltd., Ord.	5	6¼ – 6¾
£150,000	Stk	4½	Do. do. 4½ Deb. Stk., Red	100	105 111
70,595	10	5	City of London Elec. Light. Co. Ld., O	10	10¾ 11
40,000	10	6	Do. 6% Cum. Pref.	10	13 – 14
£100,000	Stk	5	Do 5% Deb. Stk., Red	100	123 127
£300,000	Stk	4½	Do. 4½ 2nd Deb. Stk., Red	100	104 –106
40,000	10	4/-	County of London Elec. Supply Co., Ltd., Ord.	10	9¼ - 9¾
30,000	10	6/-	Do. 6% Cum. Pref.	10	12 – 12½
£400,000	Stk	4½	Do. 4½% Deb. Stk., Red.	100	107 110
£250,000	—	4½	Do. 4½ 2nd Deb. Stk., Prv. Crts. all paid, Red	100	101 – 103
85,000	3	1/6	Crompton & Co., Ltd.	3	1½ - 1¾
£100,000		5%	Do. 5% 1st Mort. Reg. Debs.	100	92 – 97
70,000	5	1/6	Edmundson's Elec. Cor. Ltd., Ord	5	5⅝ – 6⅛
70,000	5	3	Do. 6% Cum Pref.	5	5⅝ – 6⅛
£300,000	Stk	1½	Do. 4½% 1st Mort. Db. Stk. Reg	100	106 –108
£80,000	Stk	5	Electric Lighting & Traction Co. of Australia, Ltd 5% Deb. Stk. Red.	100	88 - 93
10,000	5	2/-	Folkestone Elec. Supply Co., Ld., O	5	5½ - 6
£50,000	Stk.	4½	Do. 4½ 1st Deb. Stk., Red	100	102 –105
15,000	10		Havana Electricity Co., Ltd.	10	9½–10½
13,000	5	3/6	Hove Elec. Lighting Co., Ltd., Ord	5	7½ – 8
£50,000	Stk	4½	Isle of Wight Electric Light & Power Co., Ltd. 4½ Deb. Stock, Red.	100	100 - 102

Stocks and Shares marked are quoted ex-dividend.

ELECTRIC LIGHTING AND POWER.—*Contd.*

Present Amount Subscribed	Shares	Last Div.	Name	Paid	Closing Prices
150,000	1	[illegible]	Kalgoorlie Electric Power & Lighting Corp. Ltd., 6% Cum. Pref.	1	[illegible]
21,000	5	[illegible]	Kensington and Knightsbridge Electric Lighting Co., Ltd. Ord.	5	12 – 13
£1[illegible]5,000	Stk.	4	Kensington and Knightsbridge Electric Lighting Co., Ltd., and the Notting Hill Electric Lighting Co., Ltd., 4% Deb. Stock, Red.	100	[illegible] 104
111,000	3	[illegible]	London Elec. Supply Corp., Ltd., Ord.	3	2 – 2
[illegible]	5	3	Do. 6% Pref.	[illegible]	6
£571,[illegible]	Stk.	4	Do. 4% 1st Mort. Db. Stk., Red	100	[illegible]
100,000	10	[illegible]	Metropolitan Elec. Sup. Co., Ld., Ord	10	[illegible]
76,121	5	2	Do. 4½ Cum. Pref.	[illegible]	[illegible]
220,000	Stk.	4½	Do. 4½% 1st Mort. Db. Sk. Red	100	[illegible] 117
250,000	Stk.	3½	Do. 3½ Mort. Deb. Stk., Red	100	97 [illegible]
£250,000		4½	Midland Elec. Corp. for Power Distribution Ltd., 4½ 1st Mort Deb	100	93 96
10,8[illegible]2	10	6	Notting Hill Elec. Ltg. Co. Ltd Ord	10	13 – 17
£[illegible],000	100	4%	Do. 4 1st Mort. Debs.	100	[illegible] 103
16,500	5	[illegible]	Oxford Electric Co. Ltd., Ord.	5	6 – [illegible]
£50,000	Stk.	4	Do. 4 Debenture Stk. Red.	100	[illegible] 101
£84,700	100	4½%	Royal Elec. Co. of Montreal 4½ 20-yr. 1st Mort. Deb	100	100 102
40,000	5	7	St. James' & Pall Mall Elec. Light Co., Ltd. Ord.	5	14 – 14
20,000	5	[illegible]	Do. 7 Pref.	5	[illegible]
£150,000	Stk.	3½	Do. 3½ Deben. Stock, Red	100	[illegible] 101
12,000	5	4	Smithfield Markets Elec. Supply Co., Ltd. Ord	5	[illegible]
£50,000	Stk.	4	Do. 4 Debenture Stk. Red.	100	[illegible] – 87
65,000	[illegible]	[illegible]	South London Elec. Sup. Co., Ltd. O.	[illegible]	[illegible] – 4½
100,000	1		South Metropolitan Elec. Light & Power Co., Ltd. Ord.	1	[illegible] 1
[illegible]	1	[illegible]	Do. 7 Cum. Pref.	1	1 1[illegible]
£100,000	Stk.	4	Do. 4½ 1st Deb. Stock Red.	100	[illegible]
[illegible],000	5	2	Urban Electric Supply Co., Ltd., O.	5	4 [illegible]
31,000	5	2½	Do. 5 Cum. Pref.	5	4 – [illegible]
£200,000	Stk.		Do. 4½ 1st Mort. Deb. Stk. Red	100	[illegible]
110,000	5	[illegible]	Westminster Elec. Supply Corp. Ltd., Ord.	5	12½ 13
28,151	5	[illegible]	Do. 5 Cum. Pref.	5	[illegible] 7

V.—TELEGRAPH & TELEPHONE COMPANIES.

Present Amount Subscribed	Shares	Last Div.	Name	Paid	Closing Prices
£31,800	100	4	African Direct Tel. Co., Ld., 4% Mt Debs., Series A, Red.	100	[illegible] 102
25,000	10		Amazon Telegraph Co., Ltd	10	1 – 1½
£7[illegible]	Stk.	[illegible]	Anglo-American Tel. Co., Ltd. [illegible]	100	[illegible]
£3,118,[illegible]	Stk.	[illegible]	Do. 6% Preferred Ordinary	100	[illegible]
£3,118,[illegible]	Stk.	[illegible]	Do. Deferred Ordinary	[illegible]	12½ 1[illegible]
44,000	5	[illegible]	Chili Telephone Co., Ltd	5	[illegible]
$15,000,000	$100	[illegible]	Commercial Cable Co., Capital Stk.	[illegible]	[illegible]
£1,[illegible]	Stk.	[illegible]	Do. Sterl. 500 yrs. 4% Deb. Stk., Red	100	[illegible]
16,000	10		Cuba Submarine Tel. Co., Ltd., Ord.	10	[illegible]
6,000	10	5	Do. 10% Preference	10	[illegible]
6,000			Direct Spanish Telegraph Co., Ord. 10% Cum. Preference	[illegible]	7 [illegible]
£50,000	[illegible]	4	Do. 4½ Debs.	[illegible]	[illegible]
60,710	20		Direct U.S. Cable Co., Ltd	20	[illegible]
£85,800	100	4	Direct West India Cable Co., Ltd., 4½ Reg. Debs.	100	[illegible]
£900,000	100	[illegible]	East. & S. African, Ltd., 4% Mt. Debs.	100	[illegible]
£200,000	25	[illegible]	Do. 4% Rg. Mt. Debs. Mauritius Subsidy	25	[illegible]
300,000	10	[illegible]	Eastern Extension, Australasia and China Tel. Co., Ltd.	10	[illegible]
£1,002,100	Stk.	4	Do. 4% Mort. Deb. Stk., Perp	100	[illegible]
£4,000,000	Stk.	[illegible]	Eastern Tel. Co., Ltd., Ord	100	[illegible]
£2,000,000	Stk.	7	Do. 3½ Pref.	[illegible]	[illegible]
£1,8[illegible]	Stk.	[illegible]	Do. 4 Mort. Deb.	[illegible]	[illegible]
1[illegible],000	10		Great Northern Telegraph Co., Ltd. (Copenhagen)	[illegible]	[illegible]
£58,700	100	[illegible]	Halifax and Bermudas Cable Co., Ltd. 4½ 1st Mort. Debs. Red.	[illegible]	[illegible]
17,000	[illegible]	[illegible]	Indo-European Telegraph Co., Ltd.	[illegible]	51 [illegible]
72,680	1	[illegible]	[illegible] Telephone Co., Ltd.	[illegible]	[illegible]
£1,5[illegible]	Stk.	[illegible]	National Telephone Co., Ltd. [illegible]	[illegible]	[illegible]
£1,[illegible]	Stk.	[illegible]	Do. Deferred	[illegible]	[illegible]
15,000	10	[illegible]	Do. 6 Cum. 1st Pref.	[illegible]	[illegible]
15,000	10	[illegible]	Do. [illegible] 2nd do.	[illegible]	[illegible]
250,000	5	[illegible]	Do. [illegible] Non-cum. [illegible]	[illegible]	[illegible]
£2,000,000	Stk.	[illegible]	Do. [illegible] Deb. Stk., Red	[illegible]	[illegible]
£[illegible]	Stk.	[illegible]	Do. 4 do.	[illegible]	[illegible]
£1,000,000		[illegible]	Do. 4 Pref. [illegible]	[illegible]	[illegible]
170,[illegible]	1	[illegible]	Oriental Telephone & Elec. Co., Ltd. [illegible]	[illegible]	[illegible]
[illegible]	1	[illegible]	Do. 6 Cum. Pref.	[illegible]	[illegible]

TELEGRAPHS AND TELEPHONES.—*Contd.*

Present Amount Subscribed	Shares	Last Div.	Name	Paid	Closing Prices
£100,000	100	4	Pacific & European Tel. 4% Guar. Debs. Red.	100	98 [illegible]
11,8[illegible]	8	4	Reuter's Telegram Co., Ltd	8	[illegible] – 7[illegible]
58,000	[illegible]	[illegible]	United River Plate Telep. Co., Ltd.	5	[illegible]
40,000	5	2½	Do. Cum. Pref.	5	[illegible]
£170,[illegible]47	Stk.	[illegible]	Do. Deb. Stock, Red.	100	[illegible] 107
1[illegible],000	10	6	W. African Telegraph Co., Ltd.	10	7 7
30,0[illegible]	2		West Coast of America, Ltd.	2	[illegible]
£150,000	100	4	Do. 4% Deb. [illegible]	100	[illegible] 101
88,321	10	[illegible]	West India and Panama Teleg. Co., Ltd., Or.	10	[illegible]
34,[illegible]	10	6/-	Do. 6 Cum. 1st Pref.	10	7 7
4,[illegible]	10	6	Do. 6 Cum. 2nd Pref.	10	[illegible] 6
£80,000	100	5	Do. Debs.	100	102 104
2[illegible],930	10	[illegible]	Western Telegraph Co., Ltd	10	13 13
£75,000	100	5	Do. Debs. 2nd Series 1906	100	102 104
[illegible]8,945	Stk.	4	Do. 4 Deb. Stock, Red	100	102 104

VI.—SHIPPING COMPANIES.

Present Amount Subscribed	Shares	Last Div.	Name	Paid	Closing Prices
32,500	10	5	Anchor Line (Henderson Bros.), Ltd., 5% Cum. Pref.	10	8½ [illegible]
£3[illegible],000	Stk.	4	Do. 4½ Red. 1st Mort. Deb. Stk.	100	98 100
£672,900	Stk.	4½	British & African Stm. Nav. (1900) Ltd. 4½ 1st Mort. Db. Stk. Red	100	[illegible]
90,000	10	[illegible]	Bucknall Steamship Lines, Ltd., [illegible] Cum. Pref.	10	6 7
£600,000	Stk.	4	Do. 4 1st Mort. Deb. Stk.	100	75 78
£750,000	Stk.	4½	Castle Line Steamers, Ltd., 4½ Deb. Stk. Red.	100	100 102
60,000	20	16	Cunard Steam Ship Co., Ltd., Nos. 1-60,000	20	13 [illegible]
40,000	20	[illegible]	Do. Nos. 60,001-100,000	10	[illegible]
£[illegible]	Stk.	4½	Elder Dempster Shipping, Ltd., 4½ 1st Mort. Deb. Stk.	100	94 10[illegible]
1,200,000	1	6d	Furness, Withy & Co., Ltd., Ord	1	1 1½
30,000	10	5	Do. [illegible] Cum. Pref.	10	9 10½
£27,[illegible]	100	4	Do. 4½ 1st Mort. Debs. Red.	100	[illegible] 107
25,[illegible]	7½	[illegible]	Gen. Steam Navigation Co., Ltd., Ord	7½	4 – 4½
[illegible]	8	[illegible]	Do. Non-Cum. [illegible] Pref.	8	6 – 7½
£150,[illegible]	Stk.	4	Do. 4% 1st Mort. Deb. Stk. Red.	100	[illegible] – 98
[illegible]	5	1½	Houlder Line, Ltd., Ord	5	3 3½
10,000	5	2½	Do. [illegible] Cum. Pref.	5	3½ 4
£2[illegible]	Stk.	4	Do. 4½ 1st Mt. Deb. Stk. Red	100	85 88
14,[illegible]	[illegible]	[illegible]	[illegible], Ltd., [illegible] Cum. Pref.	[illegible]	[illegible] – 3
£1,[illegible],000	Stk.	[illegible]	P[illegible] Steam Nav. Co., [illegible] Cum. Pref.	100	[illegible]
£1,[illegible],000	Stk.	7	Do. [illegible] Deferred	100	[illegible]
£[illegible],000	Stk.	[illegible]	Do. [illegible] Deb. Stock	100	[illegible] 101
£[illegible]	Stk.	[illegible]	Do. [illegible] Deb. Stk.	100	[illegible]
[illegible]	100	[illegible]	[illegible] Mail [illegible] Ord	[illegible]	[illegible]
3,607	[illegible]	[illegible]	[illegible], Ltd., [illegible] Cum. A Pref.	[illegible]	4 [illegible]
[illegible]	[illegible]	[illegible]	Do. B Ord.	[illegible]	4 4½
14,[illegible]	10	4	[illegible] Mail [illegible], Ltd., Ord	10	[illegible]
25,000	10	[illegible]	Do. [illegible] Cum. Pref.	10	[illegible] 10
£[illegible]	Stk.	4	Do. [illegible] Deb. Stock, Red	100	[illegible] 102

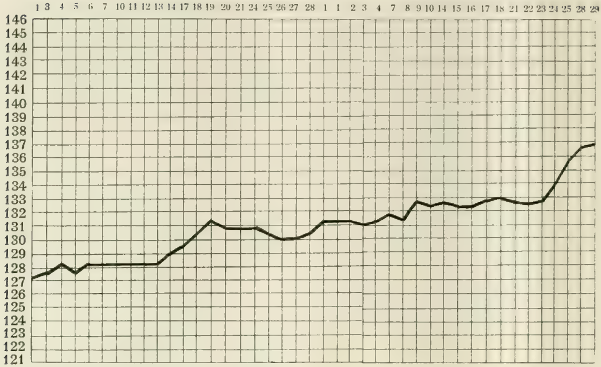
VII.—MISCELLANEOUS COMPANIES.

[illegible]

[illegible]

THE HOME METAL MARKET.

TWO MONTHS OF TIN.



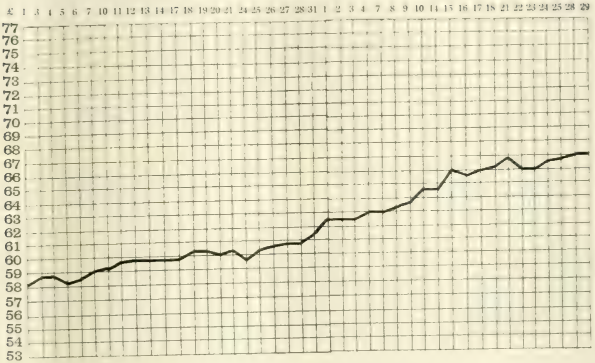
THE chart which appears above traces the history of the metal during the past two months, and it will be noted that the upward movement in the quotation for the metal has gone on almost uninterruptedly. All attempts to bang the market by bear sales have been futile, strong consumptive demand and speculative operations for the rise acting as an effective check on the endeavours of dealers to depress prices. Indeed, just prior to the Banca sale, when there was a combined attempt to put the market lower, the strength of the metal was such that large sales had to be made to keep the market from running away.

The statistical position has of course, been such as to materially assist operations for the rise. Early in October the stocks of Straits tin in London were practically depleted, and by the end of the month supplies had further diminished to an extent which produced covering on the part of the "shorts," with the result the price of the metal spurted £2 in a single day. This, however, had the effect of bringing out stocks, and in addition the position of "spot" metal was relieved by option dealers foregoing their right and leaving operators with a surplus of cash tin All offerings of metal were, however, readily absorbed, and the check to the upward movement was of a purely temporary character

At the end of October, Merton and Co.'s figures showed the total stock in England and Holland was 9,942 tons, compared with 10,854 on September 30th, and 9,080 tons on August 31st. In spite of the position thus disclosed dealings in the early days of November were inclined to dulness, the market being shorn of much of its usual vitality, due to some extent to the uncertainty as to the American demand, and an inclination on the part of Eastern dealers to accept lower prices. In fact three months' tin went as low as £130 15s. immediately prior to the American Presidential election, but on the news of the victory of President Roosevelt cash tin rose to £132 10s., and three months changed hands again at £132. At that figure it remained, all attempts to depress the market being futile.

The Banca sale last week saw very good prices, the average for the 53,200 slabs sold being unexpectedly high, and on this the market again rose sharply with the effect of bringing out some old holdings with the view to checking the improvement in values. However, in spite of this the market remains firm and although the rise to the present price of £136 15s. which is £20 above the price on June 30th, is largely based on speculation, the bullish feeling is probably quite justified, the condition of the tin trade being good, while an increased demand on American account is anticipated

TWO MONTHS OF COPPER.



ONE outstanding feature of the metal markets during the past two months has been the steady and persistent rise in copper. The diagram on this page which records the fluctuations of the metal during October and November shows that, with rare exceptions the line of value has been gradually reaching a higher level.

The average price of the metal for the first half of the current year was about £57, and copper remained round about that figure until the beginning of September. The quotation is now some ten points above that level and various reasons are being advanced to explain the rise in the price of copper to a figure which is in excess of any price attained since [illegible].

In the latter year copper touched £73, in [illegible] it stood as high as £7[illegible] 10s., and indeed during the two years [illegible] and [illegible] copper maintained a price of [illegible] a ton. There was a slump in the latter part of [illegible] to £45, and for lower prices than this one has to go back to 1894 when copper was under £40, or to 1887, when the record low figure of £35 was witnessed. This was a reaction from the record high price of 1888 when copper stood at the unprecedented figure of £[illegible] per ton. Those were days of [illegible] speculation, of disorganized and feverish markets, of hampered and restricted trade, and there are not wanting critics who assert that the rise in the price of copper during the present year is almost entirely the result of speculative dealings, and who hint that history may be about to repeat itself. In our opinion this view is not wholly correct. There is bound to be a certain amount of speculation accompanying a sudden rise in the price of any commodity, but the reasons for the rise in the price of copper during the past two months lie somewhat deeper.

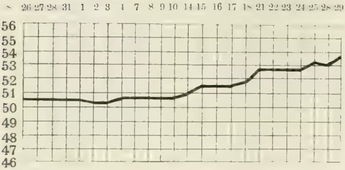
It will be interesting in this connection to glance at the statistical position. Production has rapidly increased during recent years; as a matter of fact, it has practically doubled during the last decade. Of the entire production America is responsible for some 50 per cent., and even during the present year America is increasing its production of copper by 8 per cent. as compared with last years' output. The world's production of copper for last year, according to Merton and Co.'s statistics, was [illegible] tons, and this year's output is estimated at about [illegible] tons. The marvel is that while production has doubled the average price of copper should be so much higher than it was ten years ago when it stood at £40. The increase in the consumption of copper is due to familiar causes, but it is perhaps not so well known that in Europe the visible supply of metal has latterly been equal to only a fortnight's consumption. No doubt there are considerable non-visible stocks, but for the moment visible supplies are at an uncomfortably low level, and the producers and the bulls are probably now in a position to dictate terms.

Copper was kept at a steady level during the early months of the present year by the falling off in American consumption, with the result that the imports to

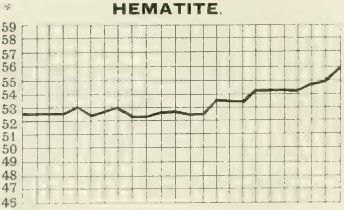
Europe were practically doubled. These extra supplies were easily absorbed on this side, but the anticipation that there will be a falling off in American shipments, owing to the renewed demand for the metal in the United States, has assisted the present spell of activity in the market. Hence it may be said that a possible shortage of supply is equally responsible with speculation for the present high price of the metal. Producers in the United States have experienced a run upon their output for months to come, and although a phenomenal rise in price of copper is not likely to be witnessed it is, difficult to resist the conclusion that we have not yet seen the top of the market, and this notwithstanding the temporary halt in the upward movement last week. No great rise can occur without occasional set-backs due to profit-taking, and the recent shake-out only appears to have strengthened the market. The latest market movements, while disclosing some irregularity, do not alter the position, the quotation still being at practically its highest point, £67 2s. 6d.

DAILY FLUCTUATIONS DURING THE PAST MONTH.

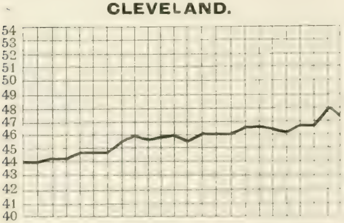
SCOTCH PIG IRON:



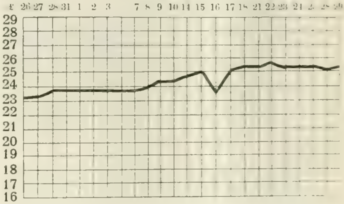
HEMATITE.



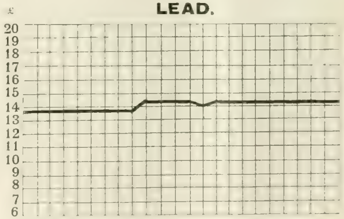
CLEVELAND.



SPELTER.



LEAD.



STANLEY CYCLE SHOW.

The twenty-eighth Stanley Cycle Show has established a record as regards the space covered and the number of firms showing cycles, motor cycles and motor-cars. The attendance was good. There were over 300 exhibitors and if the show produced no remarkable developments in the ordinary cycle, it may be said to have inaugurated the era of the cheap standard bicycle. The greatest novelty was to be found in the section devoted to the motor cycle, which is still in a period of evolution. While some makers are increasing the power of the engine to three and three and a half h.p., others are endeavouring to produce a lighter machine with a consequent reduction in the power of the engine.

PRICES CURRENT OF COAL, IRON, STEEL, AND OTHER METALS.

MANUFACTURERS' AND MERCHANTS' QUOTATIONS.

MARKET REPORT.

Wednesday, November 30th, 1904.

COPPER has been less active during the past week, and has shown a condition of extreme sensitiveness to the movements in copper shares, a drop in Tintos causing a sharp fall in the metal, the comparatively low figure of £60 being accepted for January copper. The bears clearly thought this was their opportunity, and heavy selling was indulged in. The lower figures, however, brought in buyers, and with American consumption still on a large scale, quotations have hardened. The American market has indeed been free of the dulness which prevailed on this side, heavy export orders for the Far East coinciding with a big home demand. Prices here are now on the up-grade again.

Tin is decidedly stronger on speculative activity since the close of the Banca sale, and is 50s. higher on the week. Prior to the sale the market had been held down but afterwards it became necessary for the manipulators to make sacrificing sales in order to retain control. The general outlook for the metal is dealt with in a special article to-day.

Spelter has again been a good market and on balance prices have further risen. There has been some speculative realisation but this does not affect the position, which as before explained is entirely due to scarcity of supply.

In the Iron and Steel Market prices declined in sympathy with the temporary flatness in copper and an improvement in the statistical position, Middlesbrough warrants being sold down to 4[illegible] for early December. The favourable reports from the States where the situation is sound and strong have, however, brought about a reaction.

Lead has been steady but prices are [illegible]. Antimony and quicksilver show little or no change.

In the coal market there is an increasing demand for best and second quality large steam, but [illegible] steam is less active. The inclement weather has had the effect of improving house coal [illegible], and the general outlook must be regarded as [illegible].

IRON, STEEL, PIG-IRON, &c.

SCOTLAND.

Messrs. David Colville and Sons, Ltd., Dalzell Steel and Iron Works, Motherwell, N.B., quote as follows. Prices delivered in Glasgow or equal :—

	£	s.	d.
Steel :			
Siemens' Steel Plates, Marine Boiler Quality	6	15	0
,, ,, ,, Land ,, ,,	6	17	6
,, ,, ,, Ship Quality Plates	5	15	0
Siemens' Steel Bars, Boiler Quality	6	15	0
,, ,, ,, Ship ,,	6	5	0
,, ,, Angles	5	5	0
Manufactured Iron :			
Bars—Dalzell	5	17	6
,, Best	6	7	6
,, ,, Horse-shoe	6	7	6
,, Angle	5	17	6
,, Best Angle	6	7	6
,, Best Best	6	17	6
,, Extra Best	7	7	6

Usual terms and extras. Special rates for delivery in England and export. The above prices subject to alteration without notice.

The Glasgow Iron and Steel Co., Ltd., Wishaw, quote as under (prices are delivered Glasgow or equal) :—

	£	s.	d.	
Steel Angles (Glasgow ♛ Steel)	5	5	0	per ton.
Steel Ship Plates (Glasgow ♛ Steel)	5	15	0	,,
Steel Bars, Ship Quality (Glasgow ♛ Steel)	6	5	0	,,
Steel Bars, Boiler Quality (Glasgow ♛ ♛ Steel)	6	15	0	,,
Steel Land Boiler Plates (Glasgow ♛ ♛ Steel)	6	5	0	,,
Steel Marine Boiler Plates (Glasgow ♛ ♛ Steel)	6	5	0	,,

Less 5 per cent. discount. Extras as per standard list.

Special prices for delivery in England and for export. The above prices subject to alteration without notice.

John Spencer (Coatbridge), Ltd., Phœnix Ironworks, Coatbridge, N.B., quote :

	£	s.	d.
Bars—Phœnix	6	0	0
,, Best	6	10	0
,, Best Best	7	0	0
,, Extra Best	7	10	0
,, Best Horse Shoe	6	10	0
,, Extra B H S	7	10	0
,, Extra Best [illegible]	8	0	0
,, [illegible]	6	0	0
,, Best [illegible]	7	0	0

	£	s.	d.
Angles —Phœnix	6	0	0
,, Best	6	10	0
,, Extra Best	7	0	0
Gas Tube Hoops—Phœnix Best	6	10	0
Plates—Phœnix		—	
,, Best Boiler	7	5	0
,, Best Best Boiler	7	15	0
,, Extra Best Boiler	8	15	0
Boiler Tube Strips—Phœnix Best Best	7	15	0

All per ton, delivered f.a.s., Glasgow, Greenock, Grangemouth, Granton, Leith, or Ardrossan. 5 per cent. discount cash monthly.

Messrs. R. Feldtmann and Co., of Glasgow, quote (Commission extra)

Pig Iron:	No. 1.			No. 3.		
	£	s.	d.	£	s.	d
Coltness, f.a.s. Glasgow	3	3	6	2	13	0
Gartsherrie ,,	2	17	6	2	12	6
Summerlee ,,	2	18	0	2	13	0
Carnbroe ,,	2	14	0	2	10	0
Langloan ,,	3	4	0	2	14	0
Calder ,,	2	18	6	—	—	—
Clyde ,,	2	17	0	2	11	0
Glengarnock, f.o.b. Ardrossan	2	17	0	2	11	0
Eglinton ,,	2	12	6	2	10	0
Dalmellington, ,, Ayr	2	13	0	2	10	6
Shotts ,, Leith	2	18	0	2	13	0

NORTH OF ENGLAND.

Messrs. W. Whitwell and Co., Ltd., Thornaby Ironworks, Stockton, quote as follows, **at works**:—

	£	s.	d.
W.W. Bars	6	7	6
W.W. Best Bars	6	17	6
W.W. Best Best	7	7	6
W.W. Best Best Best	7	17	6
W.W. Best Shoe	6	17	6
Thornaby	7	17	6
Thornaby Best	8	7	6
Thornaby Best Best	9	7	6
Whitwell Special Admiralty Cable	10	0	0
Special Chain Iron	9	0	0
Tube and Nail Strips	6	10	0
W.W. Angle Iron	6	10	0
W.W. Best Angle Iron	7	0	0
Tee Iron, to 8 inches United	7	7	6

Terms, Cash, less 2½ per cent. discount on 10th of month following delivery.

LANCASHIRE.

The Pearson and Knowles Coal and Iron Company, Ltd. Dallam and Bewsey Forges, Warrington, quote:—

	Iron.			Steel.		
	£	s.	d.	£	s.	d
Crown (BNF) Bars	6	10	0	7	0	0
,, ,, Angle	7	0	0	7	10	0
,, ,, Tees	7	10	0	8	0	0
,, (WIW) Hoop	7	0	0	7	10	0
,, ,, Sheet	7	10	0	8	0	0

Ordinary Sizes, F.A.S. Liverpool in 10 ton Lots.
Extras for Sizes and Cutting as per List.

WORCESTERSHIRE.

Baldwins Ltd. (with which is amalgamated Knight and Crowther, Ltd.), Wilden Works, near Stourport, quote:—

	Singles 20 G 96in. by 36in. per ton.			Doubles 21 G to 24 G 96in. by 36in. per ton.		
Black Sheets:	£	s.	d.	£	s.	d
"Vale"	10	0	0	11	0	0
"Shield"	10	10	0	11	10	0
"Severn"	11	10	0	12	10	0
"Baldwin Wilden B"	12	10	0	13	10	0
Charcoal	16	10	0	17	10	0
Best Charcoal	18	10	0	19	10	0

Pickled cold-rolled and close annealed sheets specially quoted for.

Extra widths, Singles to 66in., Doubles to 56in., Lattens to 46in. Extra lengths, Singles to 168in., Doubles to 132in., Lattens to 108in.

	Singles 20 G to 108 by 36in. per ton			Doubles 21 to 24 G to 96 by 36in. per ton.		
Tinned Sheets:	£	s.	d.	£	s.	d.
Best Coke (Finish)	28	0	0	29	10	0
,, Charcoal (Finish)	30	0	0	31	10	0
Extra ,, ,,	32	0	0	33	10	0

Cotton Can Tin Sheets to 39in. by 36in. specially quoted for
Tin Plates, "Cookley, K" Best Charcoal, £1 7s. 0d. per box

Patent Coated Sheets:	£	s.	d	£	s.	d.
No. 3 Lead	13	10	0	14	10	0
S.V. Lead	15	0	0	16	0	0
No. 3 Terne	15	0	0	16	0	0
S.V. Terne	16	10	0	17	10	0

Extreme sizes in Tin and Patent Coated specially quoted for.

Lattens up to 36 wide by 27 W G. £1 10s. 0d. per ton extra throughout for all brands.

At works less 2½%, for cash monthly, 10th inst.

Galvanized Corrugated Sheets:

	£	s.	d.	
"Phœnix" Brand, 24 G., f.o.b. London, in Bundles	11	10	0	per ton.
"Blackwall" Brand, 26 G., in felt lined cases for Australia, f.o.b. London	14	0	0	,,

Galvanized Working Up-Sheets:

	£	s.	d.	
24 G., f.o.b. London, in Bundles	13	10	0	per ton.

WALES.

Cordes (Dos Works), Ltd., of Newport, Mon., quote "Star" brand patent wrought nails, steel nails, &c.

Discounts—

45 per cent off 1 inch to 3 inch strong rose and all fine rose and 6dy. and 8dy. pound.

40 per cent off 3½-inch to 7 inch strong rose and 10dy and 20dy pound.

40 per cent off all sharp-pointed nail.

Delivered in lots of 2 cwt and upwards. Extra 2½ per cent discount off the gross on two tons and upwards.

Steel roses, flat points, 5 inch to 7 inch basis.—
2 tons 9/3 per cwt.
Under 2 tons 9/6 per cwt
del'd any Railway Station.

Steel cut nails, 3-inch basis—
2 tons 8/- per cwt
Under 2 tons 8/3 per cwt
del'd any Railway Station.

Slit rods (iron) £7 10s. per ton, at works for 2-ton lots.

Messrs. Richard Thomas and Co., Ltd., of 3, Love Lane, Eastcheap, E. C. — Works: South Wales, Burry, Lydney, Lydbrook, and Cwmbwrla, quote: —

	Per Box f.o.b. Wales. £	s.	d.
Coke Tin-plates.			
C 18¾ by 14 124s. 110 lb. "BV"	0	13	0
C 20 by 10 225s 155 .. "Jumbo"	0	18	3
C 20 by 14 112s. 108 ,, "Lydbrook"	0	12	6
C 28 by 20 112s 216 .. "Lydbrook"	1	5	3
Charcoal Tinplates:			
C 20 by 14 112s 108 lb "Allaway"	0	13	3

BELGIUM.

C. L. Faulkner, Suffolk House, Laurence Pountney Hill, London, E.C., quotes: —

Prices quoted are in £ stg. and per ton of 1,015 kos. (2,240 lb.) delivered free on board ANTWERP for approved quantities.

Steel:		£	s.	d	
Blooms	at	3	11	0	per ton.
Billets	at	3	13	0	..
Sheet Bars	at	3	15	0	..
Finished Steel:					
Bars	at	4	14	6	per ton.
Angles	at	4	15	6	..
Tees	at	4	19	0	..
Joists	at	4	7	6	..
Fencing Standards	at	4	18	6	
Shoeing Bars	at	5	2	0	
Tyre Bars	at	5	4	0	
Half Round Bars	at	5	2	6	
Heavy Rails	at	4	0	0	
Light Rails	at	4	16	0	

Structural Steelwork. Prices on application.

METALS.

Messrs. French and Smith, 147, Leadenhall Street, and 11, Oldhall Street, Liverpool, quote:—

TIN.

Tin:	£	s.	d.		£	s.	d.	
English [illegible] Ingots ...								
Do. 1½	136	10	0	to	137	0	0	per ton
London or Liverpool Bar —[illegible] Bonus								
Do. 1½	137	10	0	to	138	0	0	..
Straits Warehouse net cash	136	7	6	to	137	10	0	
London 3 months fixed	135	15	0	to	135	17	6	
Warehouse, London								
Australian net cash	136	7	6	to	137	10	0	
Banca	137	0	0	to	138	10	0	
Billiton	137	0	0	to	138	10	0	

COPPER.

Copper:	£	s.	d.		£	s	d.	
Ore	0	11	9	to	0	12	9	per unit
Regulus, Matte and Precipitate	0	13	0	to	0	13	6	..
Chili Bars G.M.B. Cash 2½	66	16	3	to	67	0	0	per ton
Swansea, Liverpool, or London 3 months fixed	67	5	0	to	67	7	6	..
Australian in Warehouse London, P. C. C. Burra Cake, Wallaroo Cake.. ...	Nominal.							
Other Brands 2½	68	10	0	to	70	0		..
English f.o.b.								
Tough Cake 2½	69	10	0	to	70	0	0	..
.. Ingot	69	10	0	to	70	0	0	..
Best Selected 2½	70	10	0	to	71	0	0	..
Sheets, Sheathing and Rods 2½	81	0	0	to	81	10	0	..
Sheets, 4 by 4 feet for India 2½	77	10	0	to	78	10	0	..
Electro, Net	69	5	0	to	69	15	0	..

YELLOW METAL.

Yellow Metal:	£	s.	d.	£	s.	d.	
Sheets, 4 by 4 feet for India 2½%	0	0	6¼	—		—	lb
f.o.b. Sheathing 2½	0	0	6¼	—		—	..

SPELTER.

	£	s.	d.		£	s.	d.	
Silesian, Net cash at out ports	25	5	0	to	25	10	0	per ton.
Special Silesian, at out ports	25	15	0	to	26	0	0	..
British, Net cash at London	25	0	0	to	26	0	0	..
Blende of 50 %	6	6	6					..
Calamine	6	10	0					..

LEAD.

	£	s.	d.		£	s.	d.	
English Pig, 2½ % at works, London, Liverpool or Swansea	13	2	6	to	13	5	0	per ton.
Spanish, 2½ %, ex ship, Bristol, Liverpool, Newcastle, Swansea, etc.	12	18	9	to	13	0	0	..
Lead Ore of 70 %	6	15	0					

ANTIMONY.

	£	s.	d.		£	s.	d.	
Star Regulus	39	0	0	to	40	0	0	per ton.
Ore (50 % good quality and produce)	8	10	0	to	9	0	0	..
Crude	14	0	0	to	14	10	0	..

QUICKSILVER.

	£	s.	d
Spanish, per flask containing 75 lb	7	15	0
Italian	7	14	0

COAL.

LEICESTERSHIRE.

The Nailstone Colliery Company, Leicester, quote: Prices per Ton at Pit at 20 cwts. with ½ Cwt. per Ton for waste:—

Upper Main Seam.	s.	d.
Main Coal	8	0
Best Hard Steam [illegible] used by the Railway Companies	7	0
[illegible]	6	6
Fine Slack	1	0

Terms [illegible]

DERBYSHIRE.

The Manners Colliery Co., Ltd., of Ilkeston quote as follows, per ton at pit:

Kilburn Coal:	s.	d
Best London Brights	9	9
Large Nuts (1½ to 3½)	9	6
Small Nuts (¾ to 1½)	6	0
Rough Brights	6	0
Peas (⅜ to ¾)	5	0
Slack	3	6
Smudge	2	0

Low Main (or Tupton) Coal:	s.	d.
Low Main Brights	7	6
,, ,, Nuts	7	3
Hards (Good Steam Coal)	8	0
Bakers' Nuts (1" to 2")	6	6
Slack	3	6

The Clay Cross Company's Collieries, Clay Cross, near Chesterfield, quote:—

	per ton at pit. s.	d.
Best Main Coal.—Best Coal, brown ash, leaving very little residue	10	6
Best Silkstone.—Brown ash, useful bagging size	10	0
Best Selected Tupton Brights.—Hand picked large Coal, of first-rate quality	9	0
Best Treble Screened Cobbles.—Through 5½-in. square mesh shaker screen, and over 2½ inch bar. Free from slack. Nice bagging size	7	9
Best Cobbles.—Good size, hot, durable, suitable for Steam work	7	3
Best Picked Hards.—A first rate Hard Steam Coal, large, giving intense heat	8	3

NOTTINGHAMSHIRE.

The Digby Colliery Co., Ltd., near Nottingham, quote per ton at pit:—

Digby Coal:	s.	d
STEAM.		
Best Hand Picked Hard	9	0
Steam Hard	7	9
Hard Nuts	7	0

Gedling Colliery.	s.	d.
HIGH HAZEL.		
London Brights, 4 to 8 in. cube	12	0
Large Nuts, 2 to 4 in. cube	9	6
Small Nuts, ¾ to 2 in. cube	5	6
STEAM TOP HARD.		
Hard Steam	8	0
Cobbles	7	0

CHEMICALS AND OILS.

CHEMICALS.

Messrs. S. W. Royse and Co., Albert Square, Manchester, quote:

	£	s.	d.	
Acids: Oxalic	0	0	2½	per lb.
Picric Crystals	0	0	11	,,
Tartaric at Manchester	0	0	11	,,
Acetate of Lime: Brown at Manchester net	8	10	0	per ton.
Grey ,, ..	11	10	0	,,
Alumina: Alum, Lump, loose	5	5	0	,,
,, ,, in casks	5	7	6	,,
,, Ground, in bags	5	15	0	,,
Sulphate of Alumina, 14%	4	10	0	,,
Ammonia: Carbonate	0	0	3¾	per lb.
Muriate Grey f.o.b. Liverpool	23	10	0	per ton.
Sal-ammoniac, Lump, 1sts, del'd U.K.	42	0	0	,,
,, ,, 2nds, ,,	40	0	0	,,
Sulphate f.o.b. Liverpool	13	0	0	,,
Arsenic: Best White Powdered net	12	5	0	,,
Bleaching Powder, 35% ,,	4	2	6	,,
Borax: British Refined Crystal ,,	12	0	0	,,
Coal Tar Products:				
Benzole, 50/90% ,,	0	0	8	per gal.
,, 90% ,,	0	0	9½	,,
Carbolic Acid Crystals, 34/35° C. ,,	0	0	6¾	per lb.
,, ,, ,, 39/40° C. ,,	0	0	7	,,
,, ,, Liquid, 97/99% ,,	0	0	9	per gal.
,, ,, Crude, 62½% at 60° F. f.o.b. ,,	0	2	2	,,
Creosote, ordinary good liquid ,,	0	0	1¼	,,
Naphtha, Crude, 20% at 120° C. ,,	0	0	3	,,
,, Solvent, 90% at 160° C. f.o.b. ,,	0	0	8½	,,
,, ,, 95% at 160° C. ,, ,,	0	0	9½	,,
,, ,, 90% at 190° C. ,, ,,	0	0	10½	,,
,, Rectified, flash point over 73° F. f.o.b. ,,	0	0	10½	,,
,, Rectified, flash point over 100° F. f.o.b. ,,	0	0	11	,,
Naphthalene, all qualities.				
Pitch f.a.s. Manchester. ,,	1	13	0	per ton.
Copperas: Green, in bulk ,,	0	12	6	,,
,, barrels f.o.b. L'pool ,,	2	0	0	,,
Cake ,,	1	2	6	,,
Copper: Sulphate	22	0	0	,,
Cyanides: 98% minimum f.o.b. net	0	0	7½	per lb.
Lead: Acetate (Sugar) White, English	27	10	0	per ton.
,, ,, ,, Foreign c.i.f. U.K.	24	10	0	,,
,, ,, Grey	21	0	0	,,
,, ,, Brown at Manchester	16	10	0	,,
Nitrate	23	0	0	,,
Litharge, Flake	15	10	0	,,
,, Powder	16	0	0	,,
Red Lead, Genuine, c.i.f. London less 5%	15	10	0	,,
White ,, ,, Dry ,, ,, ,,	16	15	0	,,
Naphtha (Wood): Miscible, 60 o.p.	0	2	10	per gal.
Solvent	0	2	7	,,
Potash: Bichromate... delivered England	0	0	3	per lb.
Carbonate, 90/92% c.i.f. Hull	18	0	0	per ton.
Caustic, 75/80% ,, ,,	20	0	0	,,
Chlorate net	0	0	3 1/16	per lb.
Montreal ,, in Store, Liverpool	35	0	0	per ton.
Prussiate, Yellow net	0	0	4⅝	per lb
Soda: Ash, Caustic, 48%, Ordinary ,,	5	5	0	per ton.
,, ,, ,, Refined ,,	6	5	0	,,
,, Carbonated, 48% ,,	5	10	0	,,
,, ,, 58% (Ammonia Alkali) net	4	10	0	,,
,, Bleachers' Refined Caustic 50/52% net	6	10	0	,,
Caustic, White, 77% ,,	10	10	0	,,
,, ,, 70% ,,	9	12	6	,,
,, ,, 60% ,,	8	12	6	,,
,, Cream, 60% ,,	8	10	0	,,
Crystals, in bags	3	0	0	,,
,, barrels	3	7	6	,,
Acetate c.i.f. Hull net	16	10	0	,,
Bicarbonate, in 1 cwt. kegs	6	15	0	,,
Bichromate... delivered England	0	0	2¼	per lb.
Chlorate net	0	0	3 1/16	per lb.
Nitrate... ex quay Liverpool	10	12	6	per ton.
Phosphate	9	5	0	,,
Prussiate net	0	0	3⅜	per lb.

		£	s.	d.	
Soda.	Silicate, Solution, 140 Tw.	4	10	0	per ton.
	Sulphate (Glauber Salts)	1	12	6	,,
	,, (Saltcake, 95%)	1	15	0	,,
Sulphur:	Recovered	4	15	0	,,
	Roll	6	15	0	,,
	Flowers	7	10	0	,,
Zinc:	Sulphate	6	15	0	,,

MINERALS.

		£	s.	d.	
Barytes:	Lump Carbonate, 90/92	3	10	0	,,
	Sulphate, No. 1, White	2	15	0	,,
China Clay:	of various qualities for all purposes; prices from about 11/- to about 30/- per ton, f.o.b. Cornwall: stocks also kept at Runcorn and Preston. Quotations given carriage paid.				
Chrome Ore:	Basis 50% c.i.f. British Ports	3	7	6	,,
Manganese:	Lump c.i.f. Liverpool 10½d. per metallic unit.				
Ochre:	French JC f.o.b. Rouen, net	2	5	0	per ton.
	,, JF	5	10	0	,,
Talc:	(French Chalk) c.i.f. Liverpool	3	10	0	,,

OILS, etc.

		£	s.	d.	
Aniline Oil	net	0	0	4¾	per lb.
,, **Salt**		0	0	4½	,,
Castor Oil:	French, 1st pressure, f.o.b. Marseilles less 1½	20	0	0	per ton.
	English, 1st pressure, f.o.r. Hull, less 2½	19	15	0	,,
Cocoa Nut Oil:	Ceylon, ex store Manchester net	31	10	0	,,
	Cochin, ex store Manchester net	33	0	0	,,
Cotton Seed Oil:	Refined at Hull, less 2½ naked	14	17	6	,,
	Edible...at Hull, less 2½% naked	15	7	6	,,
Glycerine:	Crude, 80% net	31	0	0	,,
Linseed Oil:	Raw at Hull, less 2½% naked	13	10	0	,,
	Boiled at Hull less 2½% naked	14	10	0	,,
Starch:	American Pearl, at Manchester, net	9	0	0	,,
	Dextrine ,, ,,	17	10	0	,,
	Farina ,, ,,	15	10	0	,,
Shellac:	Quiet in sales of 200 chests TN orange. December delivery at	11	10	0	per cwt.
Turpentine	American at Liverpool	39	5	0	per ton.
	Russian at Hull...net	20	0	0	,,

TIMBER.

Messrs. Alfred Dobell and Co., Liverpool, quote:

COLONIAL WOODS.

Timber.

		£	s.	d.		£	s.	d.
Quebec Square White Pine...	per cub. ft.	0	1	9	to	0	3	0
Quebec Waney Board Pine...	,,	0	2	8		0	3	9
St. John Pine, 18 in. average	,,	0	2	3		0	3	3
Lower Ports Pine	,,	0	1	1		0	1	6
Quebec Red Pine	,,	0	1	6		0	1	10
Quebec Oak, 1st quality	,,	0	2	9		0	3	3
Quebec Oak, 2nd quality ...	,,	0	1	6		0	2	6
Ash	,,	0	1	6		0	2	3
Elm	,,	0	3	0		0	3	6
Hickory	,,	0	2	0		0	2	6
Quebec Birch	,,	0	1	6		0	2	3
St. John Birch	,,	0	1	6		0	2	0
Birch Planks....	,,	0	0	9		0	0	11
Spruce Spars	,,	0	0	10		0	1	0

Deals.

		£	s.	d.		£	s.	d.
1st quality Quebec Pine	per std.	22	10	0	to	32	10	0
2nd do. do.	,,	17	0	0		22	0	0
3rd do. do	,,	11	10	0		13	0	0
St. John, N.B., etc., Spruce	,,	6	10	0		6	15	0
Lower Ports Spruce..	,,	6	0	0		6	10	0
Spruce Boards	,,	5	10	0		6	0	0
Lathwood	per fathom	3	12	6		4	0	0

UNITED STATES, etc., WOODS.

Pitch Pine.

		£	s	d		£	s.	d.
Hewn	per cub. ft.	0	1	3	to	0	1	8
Sawn	,,	0	0	10		0	1	6
Planks, Stowage	,,	0	0	10		0	1	0
Boards, Prime	per std.	12	10	0		16	0	0
Oak Timber	per cub. ft.	0	1	6		0	2	6
Oak Planks	,,	0	1	6		0	2	1
East India Teak	per load	12	0	0		15	0	0
Greenheart	,,	6	15	0		7	10	0

EUROPEAN WOODS

Timber.

		£	s.	d.		£	s	d.
Riga Redwood	per cub. ft.	0	1	9	to	0	2	3
Dantzic and Memel Fir, Crown	,,	0	2	1		0	2	6
Dantzic and Memel Fir, Middling	,,	0	1	9		0	1	10
Stettin	,,	0	1	9		0	1	11
Swedish	,,	0	1	2		0	1	4
Riga Whitewood	,,	0	1	3		0	1	6
Norway Mining Timber	,,	0	0	9		0	0	10
Dantzic and Stettin, etc., Oak..	,,	0	2	6		0	3	0

Wainscot Logs.

		£	s.	d.		£	s.	d.
Crown		0	4	6		0	5	0
Austrian		0	4	0		0	4	6
Norway Spars	,,	0	1	2		0	1	9

Deals.

		£	s.	d.		£	s.	d.
Red Archangel and Onega, 1st quality	per std.	19	0	0		20	0	0
Red Archangel and Onega, 2nd quality	,,	16	0	0		17	10	0
Red Archangel and Onega, 3rd quality	,,	12	10	0		15	0	0
St. Petersburg, 1st quality	,,	16	0	0		17	10	0
Do. 2nd	,,	14	0	0		15	0	0
Gefle	,,	14	0	0		17	10	0
Wyburg ..	,,	12	10	0		14	0	0
Uleaborg	,,	12	10	0		14	10	0
Gothenburg	,,	14	0	0		17	10	0

Flooring Boards—Whitewood.

		£	s.	d.		£	s.	d.
Mixed 1st and 2nd quality, planed (c.i.f.)	per std.	8	5	0		8	15	0
3rd quality planed (c.i.f.)...	,,	7	10	0		7	15	0

Lathwood:

		£	s.	d.		£	s.	d.
St. Petersburg and Riga 8 feet	per fm.	10	10	0		11	10	0
St. Petersburg and Riga—4 feet		5	5	0		5	10	0

SELECTED PATENTS.

Compiled expressly for this journal by **Messrs. Page and Rowlingson, Engineering Patent Agents, 28, New Bridge Street, London, E.C.,** and at Manchester.

Copies of Specifications may be obtained at the Patent Office Sale Branch, 25, Southampton Buildings, Chancery Lane, London, W.C., at the uniform price of 8d.

NEW PATENTS APPLIED FOR.

24,600. C. B. Crawshaw and D. Bannister, Halifax. Nov. 14th.—Improvements in lubricators.

24,602. W. Copley and A. Ramsden Copley, Halifax. Nov. 14th.—An improved reversing motion for open side planing machines.

24,604. W. E. Sumpner, Sevenoaks. Nov. 14th.—Improvements in or relating to power factor indicators.

24,611. R. Thornley, Manchester. Nov. 14th.—Improvements in folding, doubling, and measuring machines.

24,617. A. Smith, London. Nov. 14th.—Improvements in or applicable to clutches for cycles, motors, machinery and the like.

24,625. N. G. K. Husburg, Sweden. Nov. 14th.—Improvements in centrifugal creamers.

24,634. R. C. Wetherell, London. Nov. 14th.—The transmission of signals to a travelling locomotive from stationary contacts on the permanent way during fogs or otherwise.

24,639. J. A. Staples, London. Nov. 14th.—Improvements in valves for water supply tanks and regulating means therefor.

24,642. J. L. Bogert, London. Nov. 14th.—Improvements in internal combustion heat engines.

24,647. J. F. Murphy, London. Nov. 14th.—Improvement in elevator controlling mechanism.

24,650. R. J. Hodges, Bedford. Nov. 14th.—Improvements in high pressure centrifugal blowers and exhausters.

24,653. R. C. F. Ogilvie, Upper Long Ditton. Nov. 14th. A new and improved rotary engine or turbine applicable also as a pump blower exhauster, or as a meter.

24,663. I. G. Waterman, London. Nov. 14th.—Improvements in electrical valve controlling-systems.

24,673. W. Downie, London. Nov. 14th. Improvements relating to induced draught for steam generator and other furnaces.

24,674. W. H. Proctor, London. Nov. 14th.—An improved lubricating device.

24,676. S. Diamant, London, Nov. 14th.—Improvements relating to speed gear.

24,688. S. D. Armand and F. L. M. Robillard, London. Nov. 14th.—Improvements in multitubular steam generators.

24,704. A. Downs, Croydon. Nov. 15th. Improvements in the variable speed gears for self-propelled vehicles, or where a variable speed is required.

24,717. F. Lightowler and A. Lightowler, Bradford. Nov. 15th. Improvements in the drawing off rollers of Noble and other combing machines.

24,725. F. W. Lanchester, London. Nov. 15th. Improvements connected with motors and driving gear suitable for motor road vehicles and the like.

24,726. F. W. Lanchester, London. Nov. 15th. Improvements in fluid pressure reciprocating engines.

24,728. H. Townsend, Yorks. Nov. 15th. Improvement for regenerator tubes.

24,738. J. T. Nicholson and D. Smith, Manchester. Nov. 15th. Improvements in lathe beds and their saddles.

24,750. J. W. Cloud, London. Nov. 15th.—Improvements in or relating to fluid pressure brake apparatus for railway and other vehicles.

24,752. E. Scopoli, London. Nov 15th.—A water tube boiler.

24,758. B. G. Bateman, A. F. Pumfrey and J. Gibson, London. Nov. 15th. Improvements in means for use in operating a sliding member of a clutch and in means for retaining said member out of engagement with another member.

24,770. O. Imray, London. Nov. 15th.—Improvements in electric signalling devices for elevators or the like. (J. [illegible] Payne, U.S.A.)

24,775. W. T. Robinson and J. Casey, London. Nov. 15th.—Improvements in elevator safety appliances.

24,785. G. Wilton and T. Wilton, London. Nov. 15th.—Improvement in, or relating to furnaces.

24,786. C. A. F. Meissner, London. Nov. 15th.—Apparatus for effecting the semi-automatic alteration of the pitch angle of the blades of adjustable screw propellers.

24,805. F. A. Haselwander, London. Nov. 15th. Improvements in or relating to explosive engines and the transmission of power therefrom.

24,806. G. J. Robins, Liverpool. Nov. 15th. Improvements in rock or coal-drilling machines.

24,820. G. Criag, Glasgow. Nov. 16th.—Improvements in metal-melting furnaces.

25,829. G. F. Miller and J. Kronier, Germany. Nov. 16th.—Improvements in and relating to packings for the chambers of water tube boilers.

24,831. E. Rothwell, Manchester. Nov. 16th.—Improvements in apparatus for actuating the points in electric tramway systems.

24,831. J. S. Price and E. L. G. Muggeridge, Sussex. Nov. 16th. Improvements in pipe couplings and connections.

24,837. C. Barclay, Liverpool. Nov. 16th.—Improvements in internal combustion engines.

24,838. R. P. Roy, London. Nov. 16th.—Apparatus for indicating, recording, and regulating temperature in steam generators and the like.

24,841. E. T. Cleathero, Altrincham. Nov. 16th.—Improvements in friction clutches.

24,845. R. E. Oddy, Leeds. Nov. 16th.—Improvements in or relating to means or apparatus for preventing accidents in hoists.

24,853. C. Bauer, London. Nov. 16th. Improved means for reducing frictional loss in turbines and like rotary machines. (F. Herles and J. Novak, Austria.)

24,862. J. Miller, London. Nov. 16th.—Improvements in or relating to steam whistles.

24,866. P. Diamond, London. Nov. 16th.—Improvements in means for supplying steam boilers with heated feed water.

24,871. J. D. Pearson, London. Nov. 16th. Improvements in drilling or boring machines for coal, slate, rock, and the like.

24,889. J. Dewrance, London. Nov. 16th. Improvements in or applicable to water level indicators for steam generators and the like.

24,890. Davy Bros., Ltd., and T. E. Holmes, London. Improvements in glands and stuffing boxes for hydraulic cylinders.

24,893. A. Lenz, London. Nov. 16th. Improvements in and relating to vacuum brake apparatus for railway trains.

24,896. J. Finlayson, D. C. Finlayson, and G. Finlayson, London. Nov. 16th. Improvements in and relating to water tube boilers, water heaters, condensers and the like.

24,897. J. Pollock, London. Nov. 16th. Improvements in and relating to the adjustable attachment of knobs or handles to spindles.

24,907. T. Burns, London. Nov. 16th. Improvements in boring tools, reamers, and the like.

24,909. R. Lawton, London. Nov. 16th. Improvements in the joints of pipes and conduits.

24,923. W. E. Howard and W. Howard, Longport. Nov. 17th. Leverage applied to a geared machine.

24,925. W. H. Northcott, London. Nov. 17th. Improved steam generators.

24,938. J. Hargreaves and H. J. Hargreaves, Halifax. Nov. 17th. Improvements in steam traps.

25,174. S. Wheldon, Manchester. Nov. [illegible]—Improved apparatus for [illegible] and annealing [illegible].

25176. P. Robinson, Birmingham. Nov. 19th.—Improvements in refrigerators.

25,182. F. van Thiel, Germany. Nov. [illegible]—Improvements in screw [illegible].

25,195. P. J. Perry, Leytonstone. Nov. [illegible]—A [illegible] governor or regulating apparatus for steam engines and the like.

25,199. F. Windhaussen, London. Nov. [illegible]—Improvements in internal combustion or explosion turbines. Date applied for Nov. [illegible].

25,209. H. H. G. Etcheverry, London. Nov. [illegible]—Improvements in endless conveyers [illegible].

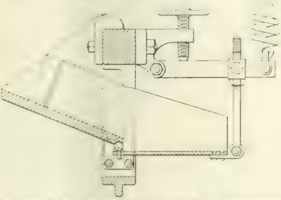
25,217. E. Van Planta, London. Nov. [illegible]. Date applied [illegible] June 23rd, 1904.

25,222. H. Handoll and R. J. White, London. Nov. [illegible]—Improvements in or relating to rotary pumps.

RECENT SPECIFICATIONS.

MINING MACHINERY.

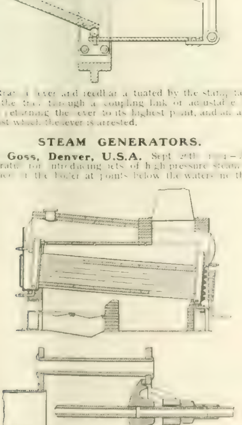
Fraser and Chalmers, Ltd., London. (Communication from H. M. H[illegible], Johannesburg.) Sept. 23rd, [illegible].—A [illegible] feeder for stamp mills, consisting of a vertical frame [illegible] with a [illegible] reciprocating [illegible] pivotted thereto, a chute from which [illegible]



on to the tray, a lever and feed bar actuated by the stamp tappet and vibrating the tray through a coupling link of adjustable length, a spring for returning the lever to its highest point, and an adjustable stop against which the lever is arrested.

STEAM GENERATORS.

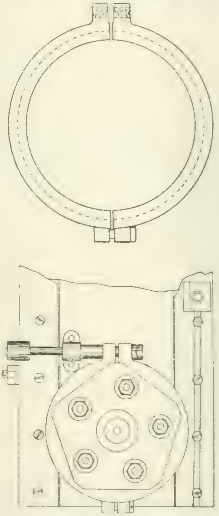
M. T. Goss, Denver, U.S.A. Sept. 27th, [illegible].—A method and apparatus for introducing jets of high pressure steam into the water space of the boiler at points below the water-line thereof to



prevent a deposit of sediment by increasing the [illegible] of the water considerably above the speed at which [illegible] when subjected to the action of heat in the [illegible].

TOOLS.

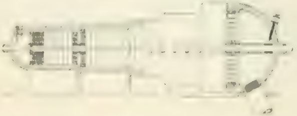
A. and H. Roberts, Manchester. Dec. 12th, [illegible].—A gripping device for [illegible] formed of [illegible] hinged together [illegible]



about [illegible] on the capstan head on the support carrying the [illegible], whereby [illegible] support and capstan are locked or unlocked, for the purpose of [illegible] a more accurate grip [illegible] into position of such turrets.

STEAM ENGINES.

M. D. Kalbach, Lebanon, U.S.A. [illegible] the purpose of [illegible] expansion of the steam or other vapour and the [illegible] a [illegible] of [illegible] cylinders of increasing [illegible] at the cylinder [illegible]



are [illegible] a plurality of [illegible] between the [illegible]

NEW PUBLICATIONS.

"THE TESTING OF CONTINUOUS-CURRENT MACHINES IN LABORATORIES AND TEST-ROOMS."

By Charles Kinzbruuner, A.M.I.E.E. Harper and Brothers. 6s. net.

This comprehensive treatise, intended for students at technical colleges, owes its origin to a number of written instructions for making experiments in the machine laboratories which the author delivered to former students in the Manchester School of Technology. Its aim is to prepare the student for laboratory practice, to explain the purpose of the various experiments, and to give him lucid and accurate instructions for carrying them out. Particular attention is devoted to the introduction of characteristic examples, the writer's experience having taught him that in most cases it is not so much the carrying out of an experiment as its application for practical purposes that offers the most difficulties to students.

Special chapters deal with resistance measurement, measurement of temperatures, insulator measurements, no-load characteristics, magnetic measurements, efficiency, separation of losses, practical testing of continuous-current machines.

The work should also prove useful to electrical and mechanical engineers engaged in test-room work, or in starting, installing, and supervising electrical machinery. The illustrations and general arrangement of the work meet with our warmest approval.

"MAGNETISM AND ELECTRICITY."

A Higher Text Book. By R. Wallace Stewart, D.Sc. W. B. Clive. 6s. 6d.

A valuable addition to the well-known University Tutorial Series, this work, designed to supersede a previous text-book by the same author, is offered to the students preparing for final degree work. It includes the essential theory of those subjects which the advance of electrical practice has brought into prominence, and although the treatment of the work is of an elementary character, the author has not hesitated to utilise the notation and first principles of the calculus—this being an essential part of the student's mental equipment—the writer is of opinion that he cannot make too early acquaintance with the rudiments of differential and integral calculus.

Having met many young men starting in electrical business without complete technical training, Mr. E. B. Raymond, of the New York General Electric Company, has written a complete handbook, "Alternating Current Engineering," which deals first with the general laws of magnetism and alternating currents, and secondly with modern alternating apparatus and methods of test. It will shortly be issued in London by Messrs. Kegan Paul.

BOOKS RECEIVED.

Who's Who 1905. 7s 6d net. Who's Who Year Book 1905 1s. net. The Englishwoman's Year Book. 2s 6d. net. A and C. Black.

A Handbook of Chemical Engineering Illustrated with Working Examples and Numerous Drawings from Actual Installation. By George E. Davis. Second Edition. Two volumes. Davis Brothers, Manchester.

Cyclopædia of Mechanics. Fourth Series. Cassell and Co. 7s. 6d.

Electricity in the Service of Man. By R. Mullineux Walmsley. Cassell and Co. 10s. 6d.

NEW CATALOGUES.

Circular No. 49 of the United Telpherage Company, of 20–22, Broad Street, New York, U.S A., gives a pictorial description of telpherage as applied to the hoisting conveying, screening, depositing and storing of coal and coke, and the removal of ashes, etc. Each of the twenty-three illustrations is accompanied by a short description. We note that circulars giving details of telpherage for mills, factories, warehouses, railroad and steamship lines, freight terminals, etc., are sent on application. Circular No. 51 describes the telpherage plant installed in the Walter Baker Chocolate Company's mill at Milton, Mass.

The Cleveland Crane and Car Company, Wickliffe, Ohio.—Bulletins "G," "H," and "J" describe, respectively, Cleveland cranes of the hand and electric jib, post and car crane types; hand-power travelling cranes; and electric travelling crane type. Bulletin "K" deals with the plain and trolley type electric hoists and electric hoist travelling cranes.

Lancaster and Tonge, Ltd., The Lancaster Works, Pendleton, Manchester. — From this firm we have received a circular containing some striking testimonials as to the efficiency of "The Lancaster" piston rings. One of these, from the Goole Steam Shipping Company, Ltd., describes a case in which these rings were found very little the worse for wear after seventeen years' use on board the ss. *Emden*.

MEETINGS FOR THE ENSUING WEEK.

FRIDAY, DEC. 2.—Junior Institution of Engineers: Paper by Mr. H. E. Yarrow, of Poplar, on "Some Points of Interest in the Construction of Torpedo-Boats," Westminster Palace Hotel, 8 p.m.—Institution of Civil Engineers: Students' Meeting, Paper by Mr. R. T. McCallum, M.Inst. C E., on the "Midland Railway, West Riding Line. The Construction of Contract No. 1."

SATURDAY, DEC. 3.—Birmingham Association of Engineers: Annual Meeting and Election of Officers, Grand Hotel, 8 p.m.—Glasgow Technical College Scientific Society, "Symposium," at 38, Bath Street, 7 30 p.m.

MONDAY, DEC. 5.—Society of Arts: Cantor Lecture by Mr. D J. Blaikley, 8 p.m.—The Master of Rolls distributes the awards at the City of London College, the Lord Mayor presides, 8 p.m.—General Meeting of the Royal Institution.—Society of Engineers meet at 7 30 p.m. South Staffordshire and East Worcestershire Institution of Mining Engineers: Ordinary Meeting at the Birmingham University, 7 30 p m.—Institution of Marine Engineers. Meeting at Romford Road, Stratford, E. 8 p.m.

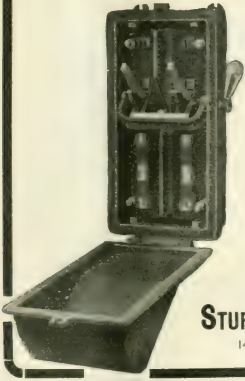
TUESDAY, DEC. 6.—Royal Colonial Institute: Admiral Sir N. Bowden-Smith presides, Paper by Mr H. F. Wyatt, on "The Navy and the Empire," 8 p.m.—University College, London, Paper by Sir John Macdonnell, C.B., 5 p.m.—University of Liverpool Engineering Society: Professor Hele-Shaw, LL.D., F R S. (President), on "Gold Mining in the Transvaal."—Institution of Civil Engineers meet at 8 p m.

WEDNESDAY, DEC. 7.—Royal United Service Institution: Paper by Major J. Moore, Whitehall 3 p.m.—Geological Society of London Meeting at Burlington House, 8 p m.—Society of Arts: Paper by Mr Walter Francis Reid, F.C.S, on "The International Exhibition at St. Louis, U.S.A.," 8 p.m. —Institution of Civil Engineers of Ireland meet 8 p m.

THURSDAY, DEC. 8.— Mining Institute of Scotland: Meeting at Hamilton. — Society of Arts the Rt. Hon. the Earl of Hardwicke presides, Paper by Sir Frederic Fryer, K.C.S.I., 4.30 p.m.— Dublin Electrical Engineers. Meeting at the Royal College of Science, Dublin. Institution of Electrical Engineers meet at Great George Street, 8 p.m.— London Mathematical Society meets at 5.30 p.m. Meeting of the Royal Society at 4.30 p.m. Institution of Civil and Mechanical Engineers. Paper by Mr. H. E. Bellamy, "Notes on Portland Cement," Caxton Hall, 8 p.m.

FRIDAY, DEC 9.—The Physical Society of London meets at the Royal College of Science South Kensington 8 p.m.—Lord Reay distributes the Awards at the Northampton Institute 8 p.m. —Lord Belhaven distributes the prizes to the Trades Training School Carpenters' Hall, 8 p.m.

PAGE'S WEEKLY Miscellaneous



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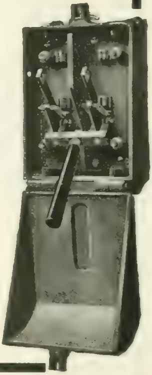

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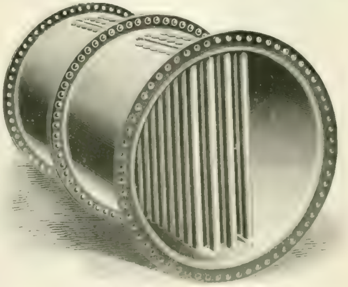

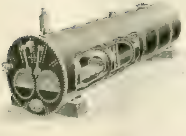

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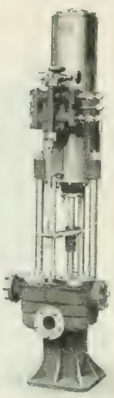

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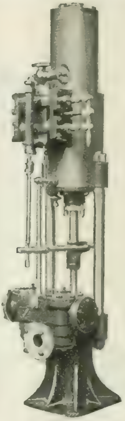

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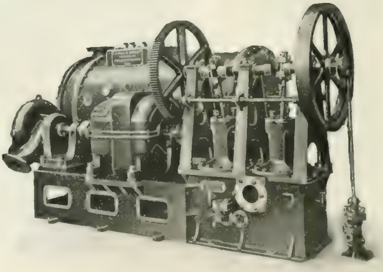

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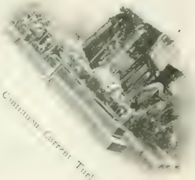
[illegible] H.P. Three-phase Turbo Generator.



[illegible] H.P. Continuous Current Turbo Dynamo.

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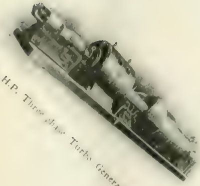
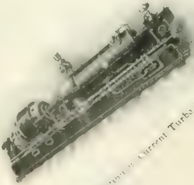


1,000 H.P. Three-phase Turbo Generator.



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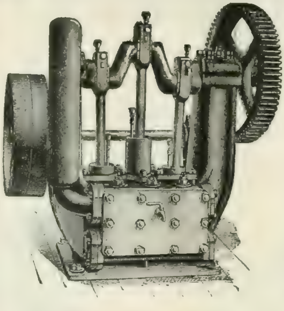

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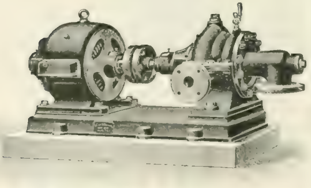

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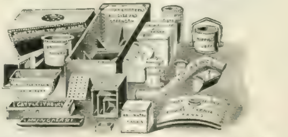

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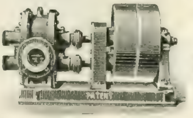

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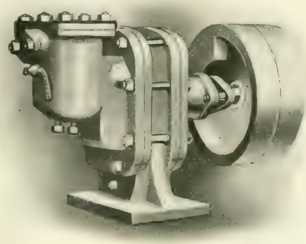

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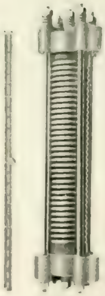

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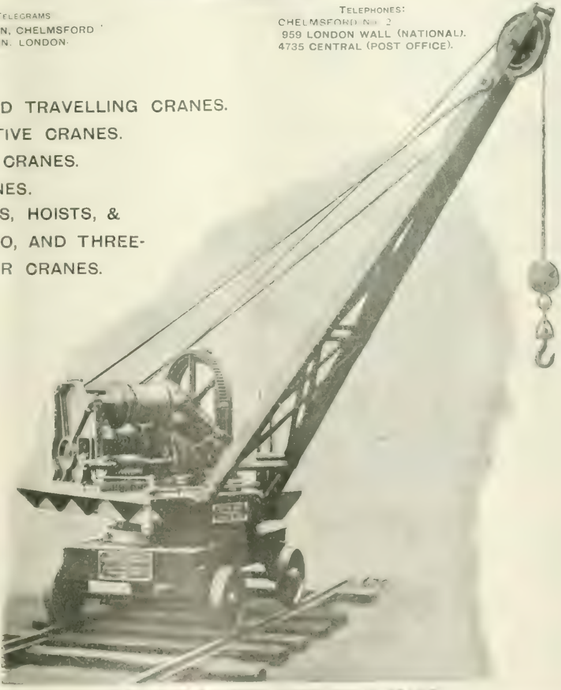

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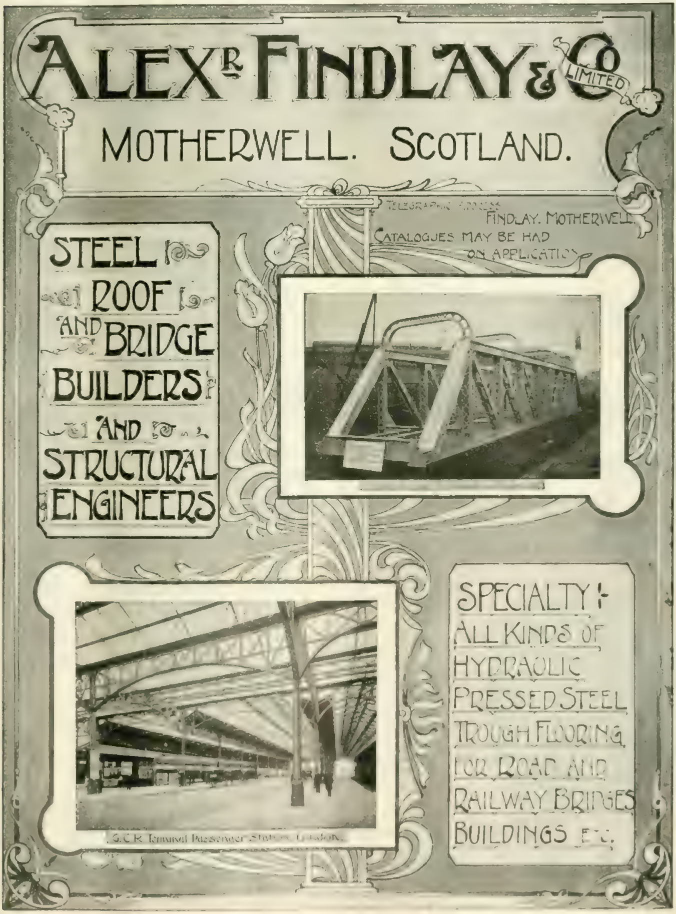

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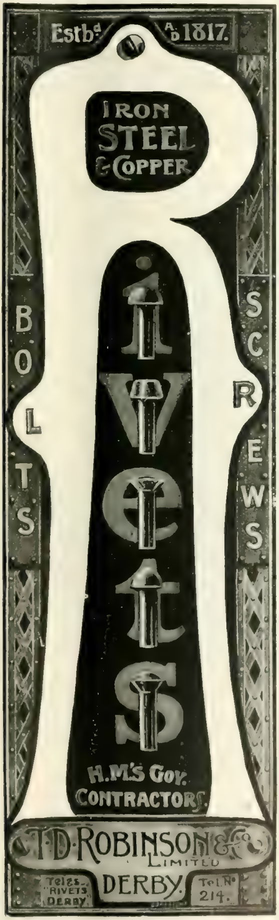

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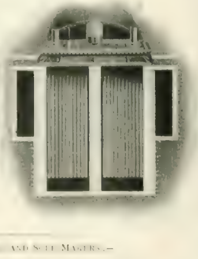

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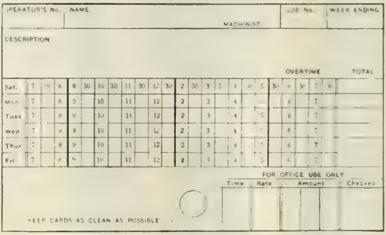

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Wed	7		8	9		10		11		12		2		3		4		5		6		7		
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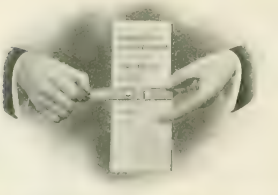

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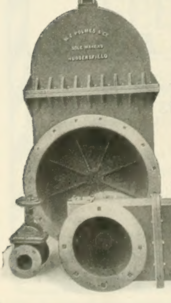

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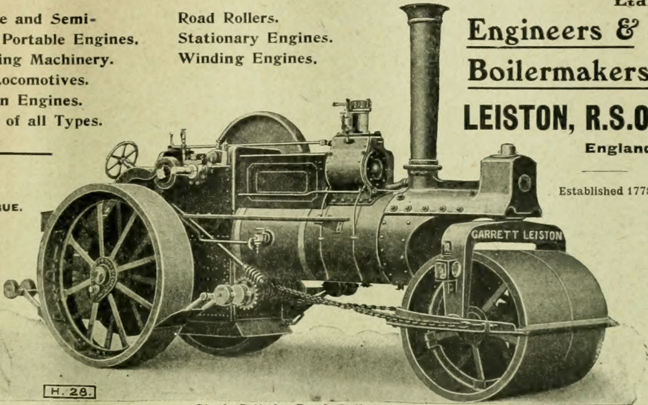

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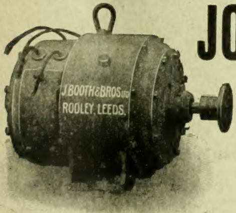

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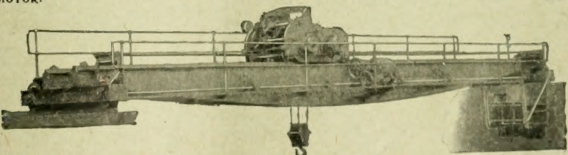

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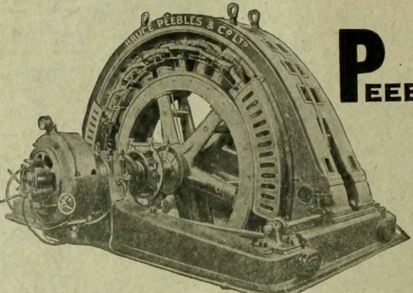

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